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NOTES

The General Certificate and General Education

It is not easy to tell anything from the correspondence in the newspapers about the General Certificate and general education in the sixth forms except that there is a wide and lively interest in the subject. Everybody agrees that very few schools give to their sixth form pupils the opportunities for continuing general education that they should have ; and almost everybody agrees that it should be possible to enable the sixth form boy or girl to continue to develop in school his general interests without preventing him from attaining the standards of work in his special subjects which we have come to expect. But how is it to be done? How do the schools which are especially enthusiastic set about it? And how are the schools which do not, or cannot, at present do very much in the matter to be induced, or enabled, to follow their example, or launch out into experiment of their own?

There seems to have grown up a wide consensus of opinion that the age limit combined with the requirements of " the Mountford concordat " have together made the position unworkable for schools. Some appear to blame the Secondary Schools Examination Council out of hand for recommending the age limit ; others seem to think that the Council may have known its business in this recommendation, and that it was the universities who made things impossible by their entrance requirements. There must be reasons behind both these views.

What are the schools going to do now, when the age bar has been removed? Are they now free to do what they want to do, subject to their well-known serious difficulties about staffing? And are the great majority of the schools going to do it, or only an enterprising few? What, too, are the universities going to do at the end of the five years of the concordat? Do they think that their present entrance requirements are in the best interests of their future undergraduates, and of the schools? Is all now well?

These questions are difficult to answer, but some of them will have to be answered. One point at least seems to emerge clearly. No one, or almost no one, wishes to diminish the influence of the

universities on sixth-form education, even though many sixth-formers will never go to the university. Everybody wishes the schools and the universities to get together in the matter and to find a solution which satisfies both ; and everybody is coming to think that this requires agreement and mutual understanding on more than examination syllabuses and regulations.

The problem of English

There is an increasing insistence in university departments, especially perhaps in the professional fields such as medicine and engineering, that the young men and women have not sufficient mastery of the English language, either for their university studies or for the handling of their professional business after they leave the universities. After all, it is said, they will have in their professions to deal with persons, and they will not get far without some skill in the use of clear, persuasive and sympathetic language. The almost universal tendency used to be to blame the schools, and to attribute it all to early specialization ; but some university teachers take the view that the good teaching of any subject, including for instance chemistry or anatomy, is *ipso facto* the teaching of clear thinking and of the use of language, and that therefore the incompetence of undergraduates in English is due quite simply to bad teaching all round.

Perhaps it can be said without much fear of contradiction that the teaching of the use of language is in effect being left very largely to the teachers of other subjects, who have to teach it by the way. No doubt the Norwood Report believed in this ; but it may be said that it is not working out very well. The hidden truth in this doctrine might perhaps be, not that anyone who can teach anything can teach the use of language, but that the use of language continues to need constant practice and study at later ages than is commonly thought. After all the professional writer must keep himself in constant practice so long as he remains a professional writer. It may be that others with their less requirements of skill in writing and speaking are subject to the universal law.

Many university teachers of professional studies are beginning to insist that their undergraduates should be taught the use of language at the universities ; that is, concurrently with the study of their scientific and professional subjects. Are they right in this, or should it be possible for the schools to make it unnecessary ? This

is surely one subject where serious discussion between school and university teachers could help to find the best answer.

The Birmingham Centre for Continued Studies

The Centre for Continued Studies which Birmingham University, with financial assistance from the Fircroft College Trust, established at Primrose Hill, has completed three years of work. It has been successfully launched, and the problem with which it is now faced is not that of securing full use of the premises, but of deciding which kinds of work to transfer elsewhere.

The activity of the Centre is a piece of extra-mural work, but the Extra-Mural Department of the University is responsible only for a proportion of the courses which are provided. For the Centre does not aim at catering for all and sundry, but at enabling the University to extend and strengthen its connexion with the industries, commerce and professions of the region, and in general to offer facilities for the continued "education of the educated", and especially the graduates of both Birmingham and other universities. Thus many of the courses—which may take the form of seminars or conferences rather than lecture courses—are of a specialized and advanced type, with students recruited by direct approaches to the industries or professions served, and with the teaching directed by members of the intra-mural staffs of the University. As a rule these courses last one or two weeks, those attending them obtaining release from work for the purpose. Shorter courses, of two or three days, are arranged by the Institute and Department of Education for teachers in the midland counties served by the Institute. Some of these are in the nature of refresher courses for teachers concerned, for example, with the teaching of science, while others deal more with problems of teaching method.

Each year a three weeks' course for foreign teachers of English has been organized in association with the British Council, but, in addition, a number of special courses have been provided for teachers from other countries, for example, Italy, France and Denmark, including university teachers. Co-operation between the University and several Ministries, especially those concerned with social services, has been made in the organizing of courses in social studies, chiefly at a non-graduate level, while students in ordinary extra-mural classes have had opportunities to supplement their part-time work with short periods of residential study.

Universities and residential adult education

The years since 1945 have seen a remarkable growth of residential adult education in this country, prompted, no doubt, by the success of courses for men and women in the Services during the war, and by writings such as Sir Richard Livingstone's *The Future in Education*. Some twenty new colleges have been established. Most of them have been founded and are supported by local education authorities, but in addition to Birmingham, the Universities of Cambridge, Manchester, Nottingham and Oxford, have all embarked on this kind of work, while Liverpool is associated with Burton Manor, and Bristol with Urchfont Manor. One interesting feature of this growth is that it is all concerned with the provision of short courses, lasting from two or three days to two or three months, whereas the five colleges which had been established earlier in the century, beginning with Ruskin, all offered, and still offer, courses lasting one or two academic sessions. A number of the Local Authority Colleges are, from time to time, used by universities for work of both an extra-mural and an intra-mural character. In this situation it may not be easy to draw a line between university and non-university residential adult education, unless Birmingham's lead in confining its provision largely to university graduates is followed. But has the increased provision, notably by the Ministry of Education, of university scholarships for extra-mural students, entirely done away with the need for courses of a non-degree character extending over one or two sessions?

Fulbright Programme

The Fulbright Programme on present plans is intended to last for twenty years in all. After only three full years of its operation it is perhaps too early to try to assess its influence on Anglo-American relations and on the universities on both sides of the Atlantic; into the account there has also to be put the reciprocal influence between the United States of America and the twenty countries, in addition to the United Kingdom, in which Fulbright Programmes are in operation—among them Pakistan, India, New Zealand and Australia, which have their own programmes. Whatever the final judgment may prove to be the figures for the United Kingdom programme alone make impressive reading. Taking the figures of the awards made to citizens of the U.S.A. in the three years 1949–50 to 1951–52, and the awards offered and accepted for 1952–53, they

number 669 graduate students, 213 university teachers, and 401 school teachers; these have been enabled to spend an academic year in British universities or schools. In the same period Fulbright Travel Grants to go to the U.S.A. have been awarded to 1,054 British graduate students and university teachers, and to 403 school teachers. The total number involved in this two-way traffic is thus 2,740.

The awards tenable by Americans in this country have been spread widely over the various departments of academic study and research. The greatest part of the awards has been given to further the academic and professional interests of scholars; but there have also been brought to this country a limited number of those interested in libraries and the practical fields of social work and adult education; Fulbright funds have helped to finance the exchange of teachers between British and American schools; and no less than 12 per cent of the U.K. Commission's funds is earmarked for a two-way traffic between the United States of America and the British Colonies.

There can be no doubt that for a programme of the size revealed in the figures given above it has got into its stride remarkably quickly and smoothly. The British universities—and it is pleasant to notice that the academic awards are being spread less unevenly each year between Oxford, Cambridge and London on the one hand, and the remainder of the universities on the other—deserve congratulations on the way in which they have found places during very crowded years for the holders of Fulbright awards. The universities, in their turn, have cause to be grateful for the skill and tact with which the Secretary of the Commission, Mr. Alan Pifer, has handled his task of placing the holders of awards in the British universities. His retirement from this post on his return to the United States at the end of the present calendar year will be a source of deep regret to the friends he has made in every university in the country.

Nature of the scheme

There is reason to believe that the reports submitted to the Commission by the holders of Fulbright awards on their stay in Great Britain show remarkably few instances of maladjustment, a gratifying appreciation of the ways of universities in this country and a better understanding of the aims and achievements of post-war Britain.

The Fulbright Programme began under the stimulus of Senator

Fulbright, an ex-Rhodes Scholar and a former President of an American State University. An Act of Congress allows part of the currencies and credits of other countries acquired by the United States through the sale of surplus property abroad to be used for educational exchanges. This means that the Commissions in Great Britain and elsewhere dispose only of the currency of the country in which they operate and have no dollars to spend. Thus in the main the United Kingdom Commission provides for Americans to come here although they also finance from sterling the cost of travel of British nationals to the United States. In order to finance their stay in America those who go there from the United Kingdom or elsewhere must either find themselves posts in which they can earn dollars or obtain awards under the Smith–Mundt Act of the United States Congress which provides an annual sum of dollars to help foreign students, lecturers, research workers and specialists to spend some time in the United States. The scale of the Smith–Mundt programme is much smaller than that of the Fulbright programme to which it is, in part, complementary. It is hoped, however, that the traffic in each direction will eventually become more nearly equal.

Length of stay

From year to year the administration becomes smoother. The announcement of travel grants for United Kingdom citizens, which were at one time given only after depressingly long intervals from the time of application—so long in some cases as to be useless—has now been speeded up. Each year the arrangements for receiving and introducing to the part of the country in which they will live the large number of American students who reach these shores in September are better. But one matter of principle seems still to divide university opinion in this country and the opinion of those who govern the selection and the conditions of appointment in the United States. In this country it is pretty generally believed that a student derives considerably more than twice the benefit from a stay of two years than from a stay of one year. For many universities it is extremely difficult to fit a student who comes for only one year into a profitable academic activity. Recently, out of approximately 150 graduate students 40 renewals for a second year have been made. But it remains unsatisfactory that, when a student first comes to a British university, plans must be made on the assumption that he will have only one year, even if a certain proportion do in practice

get renewals towards the end of the time for which they were originally appointed. It is to be hoped that two-year awards will become the rule rather than the exception. In the opinion of British universities the gain of a two years' stay would greatly outweigh the loss which would be involved in the reduced number whom the programme reached.

The original aim of the Fulbright Programme was to encourage the growth of a corps of responsible leaders in each country who had acquired the experience abroad needed to mature their natural persuasion towards Anglo-American unity into a firm conviction. It is fortunate that it has been so clearly realized by those who have had in their control the formulation of policy that the way best to promote the most durable Anglo-American understanding is to bring together scholars from both sides of the Atlantic who share a common passion for some branch of learning or scholarship whatever it may be.

Travel within the Commonwealth

The Congress of the Universities of the British Commonwealth, held at Oxford in 1948 and attended by representatives of 83 universities, stressed the importance of interchange visits within the Commonwealth by members of university teaching staffs. To help to meet this need a fund for a system of travel grants has been provided by the British Council and administered by a committee comprising representatives of the Committee of Vice-Chancellors and Principals, of the Association of the Universities of the British Commonwealth, and of the Universities Advisory Committee of the British Council. During the past four years, 197 grants have been made to university teachers and research workers to cover the cost of journeys between the United Kingdom and other Commonwealth countries, and of these 28 were awarded to universities in the United Kingdom.

The scheme has thus made a successful start. But its very success has created problems of some urgency which will have to be faced in the near future. As the scheme has become more widely known within university departments, the number of applications has increased by approximately 50 per cent. each year, without a corresponding growth in the funds available. The result has been that an increasingly large proportion of the applicants have been disappointed. Moreover it has not been possible as yet to include

Colonial university institutions in the scheme. And while travel between one Dominion and another was originally envisaged as an important part of the project, this has not been practicable owing to the limitation of financial resources.

Representatives of Commonwealth universities overseas who have benefited from the scheme have themselves expressed a certain embarrassment that the finance has hitherto been provided entirely by the United Kingdom taxpayer. It seems clear that if the service is to develop as experience has shown to be desirable it should be financed in part by contributions from other Commonwealth countries. This is a question which will doubtless come up for consideration at the next Congress of Commonwealth Universities to be held in Cambridge in the summer of 1953. The pilot experiment undertaken by the British Council has demonstrated the genuine value of this contribution to Commonwealth university relationships, and it is to be hoped that the development of the scheme and the enlargement of its scope will not be impeded through the lack of the necessary funds.

Southampton University

The foundation of a new university is still a rare enough event to quicken the academic pulse. The customary apprenticeship—long and exacting—as a university college has ended for Southampton with the granting of its Charter. It deserves and will receive a warm welcome into the senior circle.

It is right to expect that each time a university is born something will be added to the stature of universities as a whole; that some new flavour will be added to university life and studies by the spirit and the aims which move the new corporation.

The omens are fair for Southampton. It is small enough to grow without losing its sense of community; it lies in an area large enough to assure to it a good nucleus of students, yet not populous enough to encourage it to be purely local; thanks to far-sighted leadership in the past and in the present it is equipped to house a high proportion of its students in fine halls of residence; in its neighbourhood is a good variety of industries of first-class importance—shipping, oil, aircraft manufacture, and agriculture.

The University is well equipped to develop the scientific and technological studies suited to the needs of the coming years; by its pioneering made in legal studies it has shown that it has the

spirit of innovation and adventure appropriate to youth. What may prove the greatest advantage in the long run is that it has been and is now well served by its laymen, among whom are men of national eminence in different walks of life. The good will of the university world goes to its Vice-Chancellor-elect, Professor James of the University of Bristol. But a special word of congratulation is owed to the first Vice-Chancellor, Sir Robert Wood, who retires this autumn. In his short seven years as Principal, Sir Robert has contributed magnificently to the present happy outcome.

A Great Philosopher of Education

John Dewey, as the *Times Educational Supplement* said in announcing his death, " was the foremost philosopher and the most influential and controversial educationist of recent times in the United States, and his writings and work were known in all parts of the world." In addition his practical work in education " led to many far-reaching changes in the methods of teaching followed in schools in every part of the United States and had considerable effect elsewhere." Very much has happened in educational affairs within the span of his long life, and in this country at least the most important developments, outside the public schools and the ancient universities, have taken place in the latter half of it, since the publication of his *School and Society* in 1899. Like other great thinkers he has been credited with methods and practical arrangements which, by the time he received wide credit for them, had become stereotyped and uninspired. But even when he was a very old man he still gave in personal intercourse a lively impression not that he was repeating old thoughts but that he was thinking. And though his main doctrines are very much part, if now only a part, of the air we breathe in the educational world, his writings can still make us think again if we read afresh. He was a good philosopher by training, at a time when philosophical training was still rooted in a pre-occupation with religion and sound learning; and he always remained a philosopher by temperament. *Humanus erat, nihil humani a se alienum putabat.* We shall be a fortunate generation if we prove to have among us today an effective writer who is thinking about education as hard and as well as Dewey did in his classic work, a little more than fifty years ago.

HISTORY AND PHILOSOPHY OF SCIENCE
Introduction

By A. D. Ritchie

Professor of Logic and Metaphysics, University of Edinburgh

The symposiasts are evidently agreed that the history of science is a subject of intrinsic interest and educational importance, and that in the past in this country it has been too little studied, understood and taught. They seem to be agreed also, though they say it rather differently, that the history and philosophy of science are closely related and the philosophy best approached through the history: in fact, that the lead given by Whewell more than a century ago has not been followed up.

For the purposes of university teaching we should distinguish four problems, connected of course, but distinct. There is (1) the teaching of the subject to science students at the undergraduate stage, and also (2) the teaching of it to Arts students who have little or no background of scientific knowledge. In both these cases the subject is intended for mind-widening purposes, and, as everybody knows, minds are inelastic and hard to widen. There are difficulties as to scope, method and relation to other studies and the difficulties are different. Roughly speaking, the science student's mind is too full of material of too great density and the Arts student's mind is not full enough.

There is also (3) the question of giving science its proper place in the historian's discipline and his exposition of human thinking, human institutions and social relations. The historian who surveys the world before the seventeenth century can perhaps afford to forget about science altogether, but not the historian of the last three centuries. This is mainly a question of post-graduate studies and can be linked up with (4) advanced study and research on the history of science. This presumably will be undertaken mainly by science graduates, but also, one hopes, by trained historians. Nothing more need be said here about (4), except that Professor Dingle has the matter in hand, in London, which is probably the best centre for such work. There are, of course, technical difficulties in dealing with the literature of the subject, which Dr. Sherwood Taylor mentions. They will deter the half-hearted and perhaps it is as well they should. The study of the history of science can never

be a " soft option ". As to (3) nothing much need be said either ; it looks as though the professional historians are now on the move.

Science and the historians

All this, however, is pretty new. In 1931 a book by several writers appeared called *Science at the Cross-Roads* containing historical distortions and special pleading in the Marxist interest. Many innocent men of science were completely taken in by it. The professional historians were not, but did not appear to be interested and took no action, except for Dr. G. N. Clark, whose *Science and Social Welfare in the Age of Newton* (1937) is an effective reply. If such a book appeared now there would be more people able and willing to deal with it according to its merits.

The awkward problems are those raised by (1) and (2). As Dr. Sherwood Taylor relates from sad experience (and Professor Dingle hints) few science students at universities want to know anything about the history of science. They think it a waste of time, for they want to know, and for the most part are taught, the science of 1952 ; that is to say the latest techniques and the latest information available. They may hanker after the science of 1962 or 1972, on the assumption that it will be the same only bigger and better, but on the whole they are content with what they get. Now, if the man of science is nothing but a special kind of technician who does the brainier kind of work, and therefore comes to work at 9.30 instead of 8, is paid quarterly instead of weekly and is (more or less) of the " boss " class, that is all quite satisfactory. That is how the government of the U.S.S.R. sees it, how many Western politicians and most Western industrialists see it and even how a few men of science see it throughout their lives. The result of taking it like that will be that after a time there will be no genuine men of science. Instead there will be third-rate technicians obstinately and superstitiously using technique the reason for which they do not understand. They will still use it with some success and only occasional disasters, which can be hushed up or for which somebody else can be blamed. They will impose rules to prevent anybody else acquiring the understanding they themselves do not possess. That is the way science appears to be going in the U.S.S.R. For centuries medicine went that way, but luckily the pioneers of the sixteenth and later centuries who tried to improve things were only despised and not liquidated.

Beyond facts and techniques

The most intelligent kind of specialist and technician, however specialized and technical his training, can in course of time arrive at some understanding of the principles (and errors) underlying what he has been taught. He can see further ahead and a bit all round, but with difficulty, if he has to do it by himself and against the weight of his training. The obvious approach to wider views beyond pure technique and purely factual information is through an account of the development of scientific thinking and methods. Indeed, unless we learn rules parrot fashion and apply them without thought, we are bound to have some glimmering of how they have been arrived at and why we use these rules, not others. Precepts here are easy ; practice is difficult. The best teachers of every branch of science (and other subjects too) all try to teach according to these precepts, so as to bring about real understanding and real width of view, but in doing so they are pulling against the current. They are making things more difficult for themselves, and they are asking students to devote time, thought and effort to something which confers no immediate advantage and might be more easily, congenially and showily employed in other ways. If a teacher, who is a master of a subject and respected by his students accordingly, cannot, while handling his own subject, induce outlooks and ways of thought as he wishes, what chance is there for an outsider teaching an extra, unwanted subject to do it ? Moreover, is the teacher of history of science to deal with all sciences throughout all their history ? If not, how is he to select ? Can he deal successfully with mathematicians, chemists, zoologists, geologists, together at one time in one place ? Perhaps these are pettifogging details of time-tables and syllabuses ; and we who take broad, wide views can ignore them.

I once ventured to put into print the statement that a course of instruction on Brewing could be made as cultural and educational, in the sense of liberal education, as one on Plato's *Republic*, with the qualification that to make it so greater genius was called for on the part of the teacher, Nobody challenged the statement, presumably because nobody except the printer read it. On reflection, I am inclined to withdraw the qualification. Consider for a moment the startling, incredible consequences that have accrued to science and technology through a brewer asking Pasteur the question : " Why does my beer sometimes go sour ? " Outside the strict

bounds of science and technology, consider the part that fermented liquors have played in human life and history. You have here an opening into poetry, politics, ethics, theology and any other subject you care to mention, except pure mathematics. Of course, if the student only wants to know the difference between barley suitable for malting and barley not suitable, and how little malt can go into the beer without making it undrinkable, all this will be wasted on him.

The test of a complete education is, as Dr. Caldin says, whether the scholars "know the kind of argument and the kind of evidence that is relevant to a given kind of enquiry", and do "not ask for a mathematical argument about the ethics of slavery, a scientific argument about the history of music, nor a philosophical argument about the size of the universe". Errors like these are rife at the present day among people of all sorts, not all scientific by any means, who profess to be educated. True, such errors were also rife in ancient Athens, according to the report of Socrates, but that is not much consolation.

In short, any scientific subject taught without something of the history and philosophy of that subject is only half taught. The problem is just the practical one of making the teaching complete.

An American experiment

Dr. J. B. Conant, in America, as Professor Dingle and Dr. Sherwood Taylor mention, has tried to tackle the problem of presenting science to Arts students (number (2) above) by his method of discussing "case histories" of important scientific advances. This seems a very sound method of approach and applicable to problem (1). Science has produced, externally, revolutions in thought ; but it has also, as the symposiasts say, proceeded by revolutions in its own thought. As soon as one revolution has worked itself out in one subject, and thought in that subject become stabilized for the time being, it is the easiest thing for the practitioners in that subject to suppose that everything in the past was sheer error and everything now held is sheer truth and, except for minor matters, complete truth. Even during a revolution it is easy enough to think that the transition to complete and final truth is just round the corner, waiting for one more technical improvement, one more piece of information, one more readjustment of theory. Quite a few prominent men have said as

much in print, in public, with the utmost solemnity and with their hands on their hearts. Theoretical physics is now in the middle of one of its many revolutions. As Whitehead said, every general belief which the nineteenth century physicists held as an article of faith is now, in principle, abandoned. What remains of the old articles remains as convenient approximation or useful simplification. Physics is not exceptional in this, but it has more theory to suffer revolution and the present one is very spectacular. The revolution that followed Pasteur's examination of sour beer was just as revolutionary, though not so spectacular. When we come to the older and greater revolutions we find it hard to see that anything happened at all, because the earlier modes of thought have faded out of sight. Dr. Conant's case history method is intended to show on a small scale how revolutions in thought took place and to persuade the student that past history is relevant to the present day. The word " relevant " shows just where the obstacle is. All attempts at mind-widening assume that the student is able and willing to carry out for himself the process that psychologists call " transfer "; to be able to see that A is relevant to B, although A and B are in some respects quite different.

In these introductory remarks I have stressed especially the question how these subjects can come in among other university studies and how they should be taught. I leave it to the other writers to explain more fully what the subjects are. This they are very well able to do. Professor Dingle is in charge of a department entirely devoted to the history and philosophy of science, Dr. Sherwood Taylor's special interest is in the history of science and Dr. Caldin's in its philosophy.

HISTORY AND PHILOSOPHY OF SCIENCE

I. By Herbert Dingle

Professor of the History and Philosophy of Science, University College, London

It is one of the paradoxes of modern life that while—on the material and intellectual side, at any rate—it is dominated by science, very few people have any clear idea of what science is. The word conjures up a vague image of machinery and atomic bombs, coupled perhaps with something unintelligible about mathematics and the vast extent of space, but very few can give even an approximately accurate definition of science or know anything at all about the way in which it originated and has come to take the commanding position which it now occupies in our civilization. This is true not only of the rank and file but also of the average scientist. He understands what he is doing about as well as a centipede understands how he walks. He does his job well enough, and he may know the immediate object of his efforts, but how it has come about that those efforts are called for, what is their significance in relation to life as a whole, and what will be their ultimate effect, are matters on which his innocence is beyond reproach. There are those who maintain that this is as it should be, and that if the centipede tried to understand walking he would cease to be able to practise it. The argument is convincing to those who emulate centipedes.

The understanding of science

It is conceivable, however, that this phenomenon indicates a defect in our educational system. If it be granted that it is a desirable thing that intelligent beings should not only be able to perform certain functions efficiently but should also have some understanding of the place of those functions in the historical process which we call the advance of civilization, and some notion of how to bring their individual lives into proper relation with those forces, whatever they may be called, which have shaped and tend to direct them—then we must be conscious of a profound dissatisfaction that the predominant influence in modern life is left to act blindly, coming from a source and driving towards a goal which we neither see nor try to see. We teach the practice of science well; we teach the understanding of science scarcely at all. It does not need long

reflection to make it clear that in this situation there are the seeds of catastrophe.

Hostility to the Arts

The position is even worse. Not only do we neglect the understanding of science, but also there are tendencies towards the suppression of those subjects which, in default of a true understanding of science, at least provide some nourishment for those sides of our nature which the blind practice of science starves; I mean the so-called " cultural " subjects, often called the " arts ". Marxism is, of course, the outstanding example of these tendencies. It does not so much suppress the arts as force them into the service of the material applications of science, and it does not neglect the philosophy of science so much as falsify it by making it conform, against history and the lessons of its own internal development, to a rigid economic dogma formulated in an age of ignorance. But the effect is much the same. The free activity of the human mind is cramped, all effort, mental and manual, must be directed to material progress conceived in a certain unchangeable form, and man is thereby converted from a free agent into a machine.

But Marxism is not alone in this respect; it is simply the best thought out and consistently developed, and the most widespread, of the forces tending in this direction. According to *The Times* of March 26th last, Sir Frederick Handley Page, speaking at a dinner of the Machine Tools Trades Association, " said it was a sad reflection that today between 50 and 60 per cent. of university students were still taking cultural subjects. He thought they should be taking subjects that would fit them for the application of science that was wanted in industry and technology ". What the students wanted to do, or felt naturally fitted to do, apparently had nothing to do with the matter; everyone, it seems, should be trained to apply science (whatever that might be) to industry and technology. It is not my purpose here to defend the arts; that may be left to those whose prime interest they are. What chiefly concerns me now is the suggestion that education, even in science, should be directed solely towards applications to industry and technology and not towards understanding; in other words, that university education should not be education but mass-production of robots.

To begin on the lowest plane, a little history would have made it clear that if you want to have successful applications of science to

industry or technology or anything else, you will be well advised not to try to fit students for such applications but to fit them for whatever their hands find to do (which is not, be it noted, necessarily what their heads think ought to be done) and the applications, among other things, will then follow. A visit to the Leonardo exhibition now on view in London would be instructive in this respect. Here was a man who, supremely among men of his time and almost of all time, had the gift of applying such science as was available to industry and technology. But what came of all his wonderful projects? Nothing at all. It was left for another Italian a hundred years later, merely through following his curiosity as to how balls would roll down an inclined plane, to lay the foundations of the philosophy which in our day has led, as by-products, to aeroplanes, to X-rays and to the atomic bomb. Galileo was inspired not by the vision of these possibilities (though he was sagacious enough not to be altogether without vision in this direction) but by the passion to understand the nature of the universe in which his lot was cast, whether or not the understanding could be turned to material use; he was, as he tells us, " led by the hand as it were in following the habit and custom of Nature herself ". He sought first, not the interests of industry and technology but the ways of Nature—or, as he would have been willing to express it, the kingdom of God—and these things were added unto him, or unto us.

Science a philosophy

Indeed, the outstanding fact about modern science is that it is not a practical undertaking at all, in the ordinary sense of the word, but the most abstract of all things—a philosophy. This is not a dogmatic statement but an undeniable fact of history. If one plots the growth of what we now call scientific knowledge against time, one finds an almost imperceptible rise up to the seventeenth century and then a sudden leap upwards which has grown steeper ever since. Evidently something critical happened at that time, something that may truly be called the origin of modern science. If all the scientific knowledge obtained before Galileo were lost, it would not be necessary to replace it for it is all included in subsequent developments. If on the other hand, the accounts of his fundamental experiments on falling bodies and Kepler's establishment of his laws of planetary motion were found to be mythical, the investigations would have to be repeated or substantiated from

other records, for on them depends the legitimacy of everything that has followed. And what these men were doing was approaching the traditional problems of philosophy in a new way. Galileo constantly speaks of his method of philosophizing, Newton speaks of the experimental philosophy, and it is clear that they regarded themselves as engaged in the same kind of pursuit as the medieval philosophers, as Descartes, and as Leibniz, only they were doing it in a more effective way. History has justified them, and what we see today as a subject existing in its own right, distinguished from philosophy by a name of its own—science—is in origin and in essence simply a particular kind of philosophy that has acquired its distinction by its success, by its potentiality for continuous growth, and incidentally, but only incidentally, by its power of being applied to material ends more effectively than were the philosophies that preceded it or those that succeeded it but were established on different lines.

The idea that science is essentially a means of material progress is false to history and it is false also to existing fact. One of the most obvious instances of this is afforded by the contrast between the Ptolemaic and the Copernican conceptions of the universe—between the idea that the Earth is stationary at the centre of things and the idea that it is a planet pursuing an orbit round the Sun. The triumph of the latter view, advanced by Copernicus but established by Kepler, Galileo and Newton, is universally acknowledged to be one of the great epoch-making advances of science, but if we look for it in the practical applications of science we do not find it. When we want to use the motions of the heavenly bodies for industrial and technological purposes, for regulating our clocks and guiding our ships to their destinations, we use the Ptolemaic conception. *The Nautical Almanac*, the authoritative guide in these matters, assumes without apology that the heavenly bodies are situated on a celestial sphere. It records their position with respect to circles fixed on that sphere, and makes no attempt to describe the orbit of the Earth but instead gives the varying positions of the Sun from day to day. What is perhaps the most fundamentally vital fact in the actual structure of science is not only ignored but directly violated in the so-called practical applications of science. And the reason is that science is a philosophy, a cultural subject, an attempt to understand the fundamental relations of our experiences, to be used in practical affairs only in so far as it

facilitates their pursuit. It is true that at the present time it can assist them to an enormous extent, so much so as to lead to the illusion that it is a practical affair itself; but if it had not been studied as a philosophy, without regard to whether or not it could be applied to anything at all, it would not have assisted them in the least; and if it ceases to be studied as a philosophy it will cease to assist them further, or will do so only to our own destruction.

Problems arising from the growth of science

One of the great difficulties in these days of seeing science as an understanding of the nature of things is its enormous growth. It has operated with such success over such a wide field of experience that extreme specialization is almost inevitable. The scientist of today must be a physicist or a chemist or a botanist or a geologist or a physiologist or one of a score of other specialities—and indeed only a very exceptional person can claim a title even as narrow as any of these—and it is hard to recognize in the intricate network of detailed relations which each of these studies reveals the principles of a universal way of approaching experience. The wood is not seen for the trees, and no analysis of a tree, however minute and accurate, will lead one to a knowledge of what a wood is or even that such a thing exists. If, therefore, science is not to perish through its own success, a special effort must be made to present to the student the soul of science as well as the particular part of its body on which he happens to be engaged. Our educational system must include science as well as the sciences. How to make it do so is a problem, and not an easy one.

One thing at least seems evident, namely, that the approach to the understanding of science must be a historical one. We must not choose the tempting but fatal path of generalizing from the present state of science, whatever epoch may be denoted by the word " present ". We are familiar enough with current philosophies of science, if they may be so called, which regard the universe, physical and mental, as exemplifying the quantum theory or the law of evolution or whatever seems to the " philosopher " in question to be the last word in his own particular study. In the nineteenth century the laws of Newtonian mechanics or the principle of cause and effect were equally the secret of Nature, and in the twenty-first century no doubt something quite different will be chosen for the same rôle. Theories and " laws " and " principles " come and go.

They are necessary for the progress of science, but they are not the essence of science. They succeed one another endlessly, but amid all the changes, gentle or catastrophic, science grows without pause. It is the continuity beneath the revolutions that reveals the heart of science, and to reach it we must study the whole historical process, for there is no other way of doing so. The philosophy of science is inseparable from the history of science, and the two must be taught together or failure will follow.

Three experiments

We are almost without experience in this matter, and whatever is done now must be largely experimental. Three types of experiment are being tried—with post-graduate scientists, undergraduate scientists, and undergraduate non-scientists, respectively. The first of these is the most highly developed. The pioneer has been University College, London, which in 1924 established a post-graduate department in "History, Principles and Methods of Science", later changed in title to "History and Philosophy of Science". This was referred to by my colleague, Dr. D. McKie, in an article in the UNIVERSITIES QUARTERLY for February, 1952. Under difficult conditions and with inadequate staff it passed through a preparatory period before the war when experiments of various kinds were tried, resulting in a scheme for courses leading to higher degrees which is essentially that now in operation. Its potentialities, however, could not be realized until after the war, when, following a period of suspension, it re-opened with a greatly augmented staff and with the pronounced blessing of the University of London, which placed it first in the list of "priorities" for post-war development. The results have been most encouraging. The number of students has grown continuously from 10 in 1945–6 to 69 at present. They come from all parts of the world, and vary in age, nationality, background, personality, indeed in almost every conceivable characteristic over as wide a range as one can imagine, consistently with their having obtained a first degree in some science or other. Last session, for example, those on the books received their first degrees at the Universities of Aberdeen, California, Durham, Glasgow, Jerusalem, Leeds, London, Madras, Manchester, Mysore, New York, New Zealand, Oxford, Queensland, Sydney, Teheran and Wales. The staff includes specialists in the history of astronomy, biology, chemistry, medicine and physics, and in the

philosophy of science, and outside assistance is obtained for the history of geology and mathematics. The students are taken through a course which includes a study of the history of all the sciences from the earliest times, leading up to a study of the philosophy of science based on the historical data. The lectures on these subjects are given in the evenings for the convenience of those otherwise engaged in the daytime. For the M.Sc. degree the students take a written examination including several papers on the work of the course, and each writes a dissertation of some 50,000 words or so on a particular subject which is studied in detail.

All the evidence goes to show that the course is arranged on the right lines. The students almost invariably show great interest, and many of them have expressed their appreciation of the value of the course, which has opened up to them a new vision of their subject and its relation to life as a whole. It is satisfactory to note that some have come from universities abroad with the additional purpose of learning the character of the course in order,if possible, to start something along similar lines in their own universities when they return, for at present no other university in the world has instituted degrees in this subject. A gratifyingly large proportion of the students are themselves teachers, whose presentation of science to their pupils can scarcely fail to be influenced by what they learn of its history and philosophy. It must be remembered, of course, that London is a specially favourable place for an experiment of this kind, since the students have the freedom of the Libraries of the British Museum, the Royal Society, and the various other scientific societies, as well as the Public Records Office and the many large public libraries which the capital city contains: full use is made of this privilege. A university in one of the smaller towns could hardly operate the same scheme so effectively, but there is nevertheless much in the London experience that could be noted elsewhere with great advantage. Many of the students proceed to higher degrees than the M.Sc. Some of them become so interested as to wish to devote their whole time to the subject. There is here a source of teachers for any other university that desires to experiment in the same direction.

Courses for undergraduates

The teaching of the subject to science undergraduates presents a much more difficult problem, and one which has scarcely yet been

tackled. Courses devoted entirely to the history and philosophy of science are impracticable for two reasons: first, because it is both impossible and undesirable to try to teach young students the nature of a subject of which they have had no personal experience; and secondly because, with very few exceptions, present-day students must qualify in a subject in the practice of which they can later earn a livelihood, and the chance of doing this in the history and philosophy of science is remote. All that can be hoped for is that science courses might include lectures that will at least reveal to the students that what they are studying is not merely a means of maintaining the machinery of existence but is primarily an attempt to understand the meaning of existence itself—that is to say, if the sadness of the reflection can be borne, a cultural subject. It is encouraging to know that a Reader in the History and Philosophy of Science has recently been appointed at Aberdeen, and at Cambridge the History and Philosophy of Science has just been made a half-subject for Part I of the Natural Sciences Tripos. There experiments will be watched with the greatest interest. No doubt, modifications of the schemes originally planned will be found necessary as the result of experience, and it will necessarily be some years before the effect of these efforts can be fully assessed. In the meantime, it may be hoped that other universities may be persuaded to attempt something along similar lines.

Practically nothing systematic has been done in this country to give Arts students a notion of the meaning of science, but in the United States of America this is the field in which the chief efforts have been made. Mainly through the initiative of Dr. J. B. Conant, President of Harvard University, courses are being organized with the view, as he puts it, of giving " students who are majoring in the humanities or the social sciences . . . an understanding of science that will help them to relate developments in the natural sciences to those in the other fields of human activity."* Dr. Conant realizes that such a student may become " a citizen, a businessman, a public servant, a lawyer, a teacher, or a writer ", who may " a decade hence be called upon to evaluate the work of scientists and to consider the ways in which such work can be organized and financed". Instead of reflecting sadly on this menace, Dr. Conant attempts

* See, for example, the Foreword to " Harvard Case Histories in Experimental Science. Case 6, Pasteur's Study of Fermentation." (Harvard University Press, 1952).

to make the best of such misguided persons by giving them some idea of the scientific attitude of mind, and his method is to present them with a number of " case histories ", *i.e.*, accounts of particular classic investigations in the history of science, drawn from as large and diverse a field as possible, by learning of which they will come to see what it is that the scientist is actually doing. Here again the experiment is at its beginning, and the verdict of experience must be awaited, but so far as one can judge at present the method of approach seems eminently sound. To extend our metaphor of the wood and the trees, the problem here is to reveal the character of the wood to those who are outside it, and the appropriate method would seem to be to show it to them from several different angles. In that way they might reasonably be expected to grasp the idea of the whole. This problem is, of course, quite different from that which faces those who are inside the wood.

To sum up, it may be said that the problem of organizing post-graduate teaching in the history and philosophy of science has been in principle solved. If every university student were to become a science graduate who would thereupon undertake to learn what it is he has graduated in, nothing more would be needed ; this would be the ideal procedure for teaching science in the fullest sense of the word. Since, however, that is not the state of affairs, we must learn how to teach the subject to undergraduates, and any reasonably conceived experiment directed towards this end is worthy of trial.

HISTORY AND PHILOSOPHY OF SCIENCE

II. By E. F. Caldin

Lecturer in Chemistry, University of Leeds

In an address to students of science, the late Professor Cornford once said :—

> " The man of science to-day works at his own field within the horizon of a certain outlook, and using a certain apparatus of concepts which are the common property of his contemporaries. If he is not a philosopher or a psychologist, he may tacitly assume that this outlook and this apparatus are the only possible ones and have always been common property, imposed upon any student of Nature by Nature herself. He may then be puzzled, if he should dip into the pages of Aristotle or Lucretius. He may there light upon some startling anticipations of recent discoveries, but he will find them embedded in a mass of what looks like nonsense. He may conclude that the ancients were like clever children, with some bright ideas, but with untrained minds, who had advanced only a little way along the one right approach to truth. This illusion is rampant in histories of philosophy and science. . . . The ancients were not moderns in the stage of infancy or adolescence. The Graeco-Roman culture was a self-contained growth, with its own infancy, adolescence, maturity and decay. After the Dark Ages and the Middle Ages, the modern science of Nature starts at the Renaissance with a fresh motive impulse. *The questions it asks are different questions. Its method is a new method,* dictated by the need to meet those new questions with an appropriate answer. . . . It differs in every respect—in method, in objective, and in underlying impulse —from the physical speculation of antiquity."*

Scientific and other modes of explanation

The scientific method is not an obvious one, easy to discover and self-evident once found. Nor did it spring fully armed from the head of Galileo, or Bacon, or Vesalius. It had to be puzzled out, piece by piece, and developed from confused beginnings. The reason is that it is a specialized method. It is a combination of observation, hypothesis and reasoning, directed to investigating the

* F. M. Cornford, " Greek natural philosophy and modern science ", in *The Unwritten Philosophy and other essays* (Cambridge, 1950). My italics.

behaviour of things. It therefore presupposes not only an interest in empirical observation, a competence in mathematics, and a conviction of the intelligibility of the world—all of which appear even in the earliest Greek thought—but the use of these in the search for a particular kind of knowledge. The particular questions that science seeks to answer are " How do things appear to behave ?" and " How can this behaviour be correlated ? " They concern the description and correlation of phenomena. These are not questions that have always been asked. The ancients, as Cornford goes on to remark, were more interested in the question " What is this thing ? " than in the minute detail of the question how it behaves. They asked " What is a man ? " or " What is justice ? " rather than " What is the law relating the speed of a falling body to the distance fallen ? " When Aristotle considers even such a phenomenon as an eclipse of the moon, he thinks of it as an attribute of the moon; not, as we more naturally do nowadays, as an event that exemplifies a general law, which is related to other laws by a theory.* We may ask, then, what happened between Aristotle and Newton to bring into prominence questions of the scientific kind, and to bring to light the method and procedure for answering them ? And what have been the mutual relations of the two outlooks and modes of enquiry ? These are problems that touch the history of European thought and life at many points, and suggest the need for a broad social history of scientific method.

The history of science has not yet been adequately studied from this point of view. Traditionally it has been written descriptively by many authors without attention to its background, and indeed this kind of history, taking account only of the internal dialectic of science, should precede all others. Some authors, like Sir William Dampier, have considered the influence of its conclusions on philosophical thought; some, like Professor Hogben, have stressed its interactions with practical needs; Professor Butterfield has emphasized the play of ideas and imagination revealed in its development. But few have considered the history of the profound change of point of view involved in asking questions of the kind characteristic of natural science, and the gradual discovery of the method that these questions require. Without prejudice to other important

* Correspondingly the account of method given in the *Posterior Analytics* is not applicable to natural science, and it is useless to approach it as a theory of induction in the modern sense.

factors, it would seem that more attention should be given to the shift in the type of explanation sought, the great change in the general direction of inquiry, that characterizes the seventeenth century. A lead was given by Whitehead in the first half of *Science and the Modern World*, but it cannot be said to have received the notice it deserves.

The rise of scientific method

Let us glance at some of the factors that would have to be considered as contributing to the intellectual history of the scientific method. The origin are of course to be found in Greek antiquity, but the immediate antecedents of science are the ideas of the sixteenth century. The notion of scientific explanation was clarified during the sixteenth and seventeenth centuries by a few men of genius living within a society in whose thought, institutions, law and literature a quite different kind of explanation was very fully developed. The ordinary educated Elizabethan took for granted a certain clear and coherent account of the relations of nature, man and God; it was drawn from philosophy and revelation. Nature, he would say, was made for the spiritual and bodily use of man: to show him something of God's perfection, and to clothe, warm, feed, please and comfort him. Man is a part of nature, but a unique part, because capable of reasonable behaviour and of access to God. In support of these views he would appeal to reason working on experience, and to an authority—whether Church or Bible—which for certain reasons he regarded as reliable. The common account of natural phenomena—what served for mechanics, astronomy, natural history and so on—was less respectable; it was based partly on observation, but largely on supposed analogies between nature and man (expressed for instance in the famous speech on "degree" in *Troilus and Cressida*).* It was more interesting as providing a symbolism and a poetic imagery for human affairs (and a most powerful and moving imagery it was) than as an exact description of phenomena from the scientific point of view. No very sharp distinction was commonly drawn between sound natural history and such allegorical inventions as the emblematic pelican. Neither the method of investigation nor the type of explanation sought in science was clearly understood except by a very few.

None the less, the thought of this epoch contained the elements

* Act, I, Scene iii.

necessary for the free and confident use of the inductive method, on which depended the rapid rise of science that we may date from the work of Galileo. The first of those elements was a firm belief in an intelligible order in nature, which the work of modern logicians has shown to be an essential presupposition of inductive generalizations; as Whitehead says, the mainspring of scientific research is "the conviction that there is an order, an order that can be unveiled". The diffusion of this conviction in Europe would seem to have been due to the recovery and critical adaptation of Aristotle's works in the thirteenth century; the principles then introduced permitted a new interest in nature as intelligible rather than as symbol, with a recognition of the autonomy of reason in the scientific field, and of the importance of sensation as the source of human knowledge. A second element was an interest in the empirical description of nature, as distinct from the search for causes of the Aristotelian types; it is significant that the nominalist tradition naturally favoured observation and classification, rather than causal interpretations, and it has been argued that in his experimental work Galileo was using a method resulting from familiarity with the discussions of a whole series of his predecessors at the university of Padua, who drew some of their leading ideas from the fourteenth-century Paris nominalists.* A third element was the use of measurement and of mathematical interpretation; this may have been supplied in part by the neo-Pythagorean strand in the fifteenth-century revival of Plato, with its stress on numbers and numerical harmonies; these notions appear to have influenced Kepler and Copernicus, and may be connected with Galileo's conviction that "the book of nature is written in the language of mathematics".† Binding these elements together was the new interest in the correlation of phenomena, the desire to understand nature in terms of laws.

The inductive method is of course the correct one to use if we want accurate descriptions and correlations of phenomena, and its use by Galileo and his successors rapidly made untenable the former account. But the change appeared at the time to be far more than a substitution of a sound description for an unsound one, for the unsound description had become firmly built into most men's

* Cf. Randall, *Journal of the History of Ideas* (1940), vol. i, p. 177.

† Cf. Koyré, *ibid.* (1943), vol. iv, p. 400; Burtt, *The Metaphysical Foundation of Modern Science* (1925), Chs. 2, 3.

thought and used as a vehicle for the popular expression of philosophical truths and as a source of imagery for human situations. The new inductive method was so successful in its own field that it was often assumed to be universally applicable and capable of answering the questions that had been traditionally dealt with by philosophers; scientific apologists such as Sprat and even Robert Boyle compared the "experimental philosophy" (science) and the "dogmatic philosophy" as though they were meant to solve the same problems. This confusion persisted, and the natural result was that, whereas formerly there was a tendency to read human characteristics into nature and think of nature on the analogy of man, now the converse was attempted: man was thought of on the analogy of nature. Thus a series of influential seventeenth and eighteenth-century thinkers would have it that man is no more than a machine, and after biology came of age in the nineteenth century, there arose new protagonists of the notion that man is no more than an animal. The mistake here is of precisely the same kind as the pre-scientific mistake; both are examples of the fallacy of the misleading analogy. The notion that natural science is the true philosophy, and that its method is applicable to all problems, is of course still prevalent; Dr. Waddington's well-known book *The Scientific Attitude* is one of its recent representatives. It is in fact one of the most characteristic notes of popular modern world-views, and its consequences in lowering the popular notion of man (and all that that implies) have been incalculable.

The general education of scientists

This line of thought has important implications for that central unsolved problem in our present teaching arrangements, the general education of scientists. "An educated man is one who knows when a proposition is proved"; one who knows how to judge fairly and critically the arguments purporting to lead to some conclusion; who knows, therefore, the kind of argument and the kind of evidence that is relevant to a given kind of enquiry. He will not ask for a mathematical argument about (say) the ethics of slavery, nor a scientific argument about the history of music, nor a philosophical argument about the size of the universe. He has an instinctive recognition of the right method to apply to a given problem. He may not be able to put into words a comparative view of rational methods, but he knows in practice when they are

correctly used and when they are not. But too many scientist graduates leave the university with the assumption that the scientific point of view is the only one relevant to modern problems, that the scientific method is the only rational one, and that scientific conclusions form the only reliable body of knowledge; they support the inflated notion of the powers of science that is common in our society. The reason is evidently that they have concentrated on the scientific point of view and have received no adequate introduction to that of, say, history or ethics. In consequence they are not only hampered in their personal development but are not well prepared for the responsibilities which society now places upon scientists. It would be a great step forward if the horizons of science students could be enlarged and if they could be brought to appreciate points of view other than that of the inductive sciences. This would, moreover, help to build bridges between science and arts students, by giving them the elements of a common language and some insight into each other's data and methods.

No doubt the most powerful influence would be that of leisure well used; time spent by students of different faculties reading each other's books, discussing each other's problems, and meeting informally their seniors. But something could be done in preparation by more formal methods. The best hope of a contribution in these terms seems to lie in bringing scientific method and cognate topics to the notice of students of science. By studying the method and history of science in a general setting, scientists could be led from what they already know to a variety of other important fields of study—logic and metaphysics, the history of ideas, the history of technics, imaginative literature. They might also begin to form the comparative view of method that should characterize our educated man. In the first place, by giving an account of the logic of scientific method as it is actually used, one can show scientists the kind of knowledge that natural science can attain—the point of view it adopts, the kind of explanations in which it issues, and hence the kinds of question to which it is relevant. Incidentally, this should enable science students to get more out of their specialized training. For presumably, when we teach science, we hope that, by inculcating the procedures of a rational method, we shall encourage the student to develop rational habits in all spheres of life, as well as in science. It is doubtful whether this transfer occurs with our present methods, but some psychologists

at least hold (what common sense might suggest) that it can be achieved if the student is made familiar not only with concrete examples of scientific method but explicitly with the principles and rational basis of the method. The notion of rational method can then be generalized and adapted to other types of problem.

This brings us to the second point. Besides the questions that science deals with, there are others that need different methods. In analysing the inductive method, we can call attention to its presuppositions, and so indicate that there are logical, epistemological and metaphysical problems to which the method of science is not applicable, even in principle, but for which appropriate methods of approach have been devised by philosophers. The problems and methods of ethics can also be introduced, by commenting on the integrity and other moral virtues required of scientists and the moral responsibilities of those who apply scientific knowledge. And so on.

Thirdly, the obvious way for scientists to approach the history of thought, and serious literature generally, is the study of the history of science from the point of view of method. The history of science opens many windows; while admiring the view from the others, it seems to me that from this one the prospect is especially rich and rewarding, and as was said earlier it has not been examined as it deserves. To give a history of scientific method in its proper setting requires nothing less than a study of the changing climate of European thought. It must include a picture of the fundamental beliefs about nature, man and God that have been held by representative thinkers, and the ways in which natural knowledge has been regarded. Such views are often ultimately reflected in works of imaginative literature by which multitudes are swayed. (For instance, the Victorian debate about the place of man in nature, provoked by scientific work, was reflected in an influential popular literature, both prose and poetry.) To introduce a young scientist to such studies, then, is to show him the roots of western civilization and to give him an incentive to read its greatest works.

These ideas have been behind various lecture courses and discussion groups held at Leeds in the last six years. The results are naturally difficult to assess, but experience suggests certain tentative conclusions about the suitability of scientific method and its history as topics for science students at a provincial university in which science is strongly represented.

The questions that come to mind concern (i) the stage of their

development at which scientists can profitably undertake such studies, (ii) the background that should first be acquired, (iii) the best method of study. Taking these in order, the following brief answers are offered with a full sense of the limited data on which they rest. It would seem that undergraduates, at least those without special experience, find these topics abstract and difficult. This is not surprising, since they have not yet mastered one branch of science, and have certainly not had time to reflect on its method, let alone compare that method with others. They do not readily follow a systematic exposition conveyed in fifteen or twenty lectures. The more intelligent and the more experienced do, however, appreciate a short course (say five to seven lectures) of " impressionistic " lectures, in which the aim is to suggest problems rather than to propose solutions Perhaps more undergraduates would be interested if they had previously had a course of " straight " history of science, describing the development of science according to its own inner dialectic. Research students are considerably more alive to the problems set them by scientific method and its modern prestige. At this stage lectures are more useful, but less so than discussion groups with their greater scope for individual contributions.

HISTORY AND PHILOSOPHY OF SCIENCE

III.

By F. Sherwood Taylor

Director, Science Museum

That the history of science should be taught in universities is not a proposition that commands universal assent. It is said by some to be a discipline that is not capable of replacing any of those in which the present university student receives his training ; the history of science, some say, is comparable with the history of law —a subject of interest but not sufficiently important to form a notable part of an undergraduate's studies. It is well then to consider whether the subject should be taught and to what, if any, class of students it should be taught, before attention is turned to the mode of teaching it.

It may be taken for granted that the post-graduate student of any university may, if he should so choose, take a subject connected with the history of science, and find a supervisor where he is best able. Whether an apparatus of teaching should be provided for such students depends both on their number and on the importance to be attached to the researches that teachers of the history of science may be expected to carry out.

Undergraduate studies

It is, however, in the field of undergraduate studies that the controversy about the value of the teaching of the history of science is most active. It would be possible to allow students to take a first degree in the History of Science or, alternatively, to make the subject rank as one of those contributory to a degree or ancillary thereto. Again, it might form the subject of a compulsory course of lectures on which questions would be asked in the final examinations, or of a voluntary course which undergraduates might attend if they chose and which might or might not be of assistance in the attaining of a degree. Finally the subject could be presented in the form of occasional lectures by persons inside or outside the university.

The part to be assigned to the study of the history of science should be assessed by the benefit that will be gained from it, and this is very differently assessed by individuals, whether students or teachers. The case for a knowledge of the history of science has been put on various grounds, all of which deserve our consideration.

The rise of natural science has been the most influential movement of the last two hundred years, and has utterly transformed man's way of living, the useful arts, and the learned disciplines. A study of the history of modern times without the history of science must therefore produce historians " damned like an ill-roasted egg, all of one side ". Not less profoundly are the philosophers affected by the methods and conclusions of modern science. If philosophy be presented historically, as commonly it is, the history of science must be part of the training of a philosopher. These arguments appear to the writer as self-evident truths, but they are gaining ground but slowly, because they run counter to our educational system. Professors of history and others who teach the subject in universities and schools are commonly too ignorant of science to be able to comprehend its history, and the courses in science available at universities are of little use to them, having been designed for the training of professional scientists. Questions on the history of science are rarely asked in history papers because the students do not answer them and the examiners are doubtful whether they can adequately correct them. A shining exception is, of course, to be found in the work of Professor Butterfield; but perhaps even he would agree that his work for the inclusion of the history of science in history courses is hampered by the low standard of scientific background in those who teach and learn. The subject needs men who are really historians and really scientists, as opposed to the many who began as the one, and only in later life sought to become the other. There is at present little inducement to anyone to achieve this feat of intellectual synthesis. The number of university posts in the history of science is very small and they present no prospects to induce brilliant men to take up the subject. What is required is such changes in university statutes as will, after a lapse of time, make the History of Science a subject contributory to a degree in history, followed by the appointment of lecturers, readers or professors, thus establishing a career in the history of science which is capable of attracting those with tastes for history and science, so discouraging them from specializing in one and dropping the other.

History of science for scientists

So much, then, concerning history of science for the historian. Now for the scientist. It may at once be said that the case for teaching the scientist the history of his subject is not unassailable.

What do we hope that the scientist—physicist, chemist, biologist, physician—will get out of his university studies ? Whatever we may hope, we have a right only to expect him to study what we prescribe for study, namely, the state and practice of his science to-day, in the year 1952. We do not ask him anything about the methods of science, the philosphy of science, the social aspect of science, or the history of science ; we generally do not provide instruction in these subjects, and therefore we ought not to be disappointed if he spends his whole time in studying the subject of his degree course. He has no time to wander down the by-paths and it will be quite difficult to persuade him that they are not side-tracks ! Just so long as Natural Science, 1952, is his goal, there will be no need for him to learn his subject historically. Science deals with matters which generally do not depend on the date, within a few thousand years, at least. Its structure is not thought of in time, but as a system which always existed, though formerly unknown. If Arrhenius or Cuvier were right, their work abides in modern science ; if they were wrong, it is better forgotten. Such is the present view of a great proportion of science students and teachers. Science, considered as the system of the universe, has no history ; but science, considered as a human activity affecting other human activities, has a history most vital for those who wish to understand science in that way.

Can the subject be justified ?

Several reasons are put forward in support of the teaching of the history of science to students of science. It is sometimes said that a study of the researches of the past may suggest ideas or methods useful in the present. That this could happen is undeniable, but it does not happen very often and certainly not so often as to justify a student in embarking on a considerable tract of difficult study for its sake. A more frequent claim is that the study of the history of a discovery presents the scientific methods in action within a reasonably small and comprehensible field. The study of, let us say, the history of the discovery of the composition of water is thus a means of showing the student how discoveries are made and how to make them.

The defect of this argument is the lack of evidence that such studies have in fact led to discoveries ; it is not enough to show that a course of study *may* have some benefit, we should at least

bring evidence that it does so. The history of science certainly affords excellent examples of the methods of science. But have we decided that students are to be taught the methods of science, other than in their normal scientific studies? I see no evidence of this, and I have yet to be convinced that the scientists who know nothing of the history of science are any worse scientists than those that do.

The strongest and most usual reason for teaching the history of science to science students is not to make them more complete scientists, but rather less. It is rightly said that the science student has extremely little knowledge of anything else but science. He lives in a scientific age, has learnt little but science in his later years at school, studies nothing but science at the university and leaves it in a state of profound ignorance of anything else but science, and is inclined to regard science as a sufficient answer to all his problems. It is not, of course, true that all science students are of this kind, for many interests themselves in art, literature, politics and the like, and educate themselves by contact with their fellows. But some do become a strange new kind of man who lives by science and despises all that cannot be arrived at according to the canons of scientific investigation. These are the people many educationalists hope to humanize by some addition to the scientific studies as now prescribed for university courses. For a century at least universities have been requiring various studies additional to science, but not with great success. If a student is required to study something which he does not feel to be necessary for the profession in which he seeks to train himself, he will give to that subject only the minimum of attention necessary for a pass and will forget it as soon as he can be done with it. For this reason, it is useless to tag literary or historical subjects on to science courses, and this is generally realized. It has been suggested in recent years that the history of science is a humanistic subject which can give the science student an understanding of the past and its great men without taking him on to unfamiliar ground. This scheme is on trial. My own experience is that rather a small proportion of science students, perhaps a third, can be sufficiently interested in the history of science to give it serious study, while another third regards it as a complete waste of time. I would suggest that science and the history of science are not as closely akin as the words would imply. The older part of the history of science requires for its study a background that students do not possess, while the newer is too much like the

elements of what they are learning. I think that the subject which should be added to the science course should include the whole impact of science upon man, in philosophy, religion, social science, technology and so on and should be treated historically : that in addition to the facts and principles of science, now learnt, the student should be shown what science is and what it has done and is doing to us. That is a subject in which the student could scarcely lack interest and it would be of obvious value to his social life.

Teaching the subject ; the responsibility of the university

If it is decided that the history of science is to be taught, there must be means of teaching it. Fortunately the subject does not call for laboratory accommodation—though re-investigation of historic experiments with the materials employed by their originators would be a very profitable study. The need is for men to teach and the money to pay them. As already hinted, nearly all the older historians of science are in a certain sense amateurs. They took a degree in something else, usually chemistry, and made the history of science first a hobby and finally a professional study. The Department of History and Philosophy of Science at University College, London, is remedying this by giving a training, in part formal and in part by research, which is steadily augmenting the country's stock of historians of science. In the past there has been a tendency for lectures on the history of a scientific subject to be given by anyone who was able or could be prevailed on to do it. Most of these lectures have been given from secondary sources and they do not compare in quality with the lectures given by scientists on science, or historians on history. Most of the men who have tried to teach the subject have done it as a parergon. This is not good enough. If the universities want effective teaching of the history of science they must pay a man of sufficient qualifications to teach and do research (which is the only way of perfecting his knowledge) just as they pay a man to give any other type of instruction. The great universities should not be content with one man ; there should be a professor and a number of lecturers or demonstrators, so as to allow of fruitful contacts of mind and a reasonable prospect of advancement. Men with the right qualifications are not easy to find. The historian of science is necessarily a polymath : he should be a scientist and understand the methods of the historian. He must know Latin—as so few scientists do to-day

—as well as the normal tongues that scientists require. It will not be easy to find such a man ready-made, but put the nearest approximation in the right post, pay him properly and do not work him to death, and he will soon become the historian of science that we require. At the moment of writing neither Oxford nor Cambridge has a teacher of the history of science. We have not come very far and have a long way to go.

Suppose, then, a sufficient staff qualified to teach, how are they to go to work They will automatically create a school of post-graduate researches in the history of science, but the university will have to make up its mind about the function it requires the history of science to fulfil. If it is decided that the subject should be taught to undergraduates, the same course will not necessarily be adapted to all of them. The science students have no background of history, the arts students no background of science, and so it is very difficult to construct a short course of lectures simple enough for all and at the same time sufficiently informative to be of use. It is therefore advisable to have separate courses in the subject for science and arts students. The scientist does not generally know the questions that the historian wants to have answered, and it is therefore better that the course should be given by a historian. It would seem that the historian should wish to assess the effect of the growth of science upon the climate of opinion and on the physical and economic factors in human history ; he would therefore require a general course drawing attention to these rather than one whose theme was the mechanics of scientific discovery.

The needs of the scientist are by no means so easily defined. If the intention of the course is to demonstrate to him the nature of scientific discovery, the caste-history system, advocated by Conant and in use at Harvard, is probably the most effective. A single important piece of scientific work is selected, the necessary books are made available, which will normally involve the making of translations, the significant points are brought out, and the student acquires a detailed and life-like knowledge of that typical piece of history, instead of the abridged, simplified and sterilized version of the general text-books. I cannot pretend to have any direct knowledge of this method, but I understand that it has proved itself.

If the intention of the course is to widen and deepen the awareness of the science-student, it is probable that a series of lectures will be more effective. I would say at once that I have found it very

difficult to interest science students in the history either of their own subject or of science in general. Neither I myself nor any of the other persons who have given courses of lectures on these subjects at Oxford have been able to maintain an audience of more than a dozen, and of these few, four or five have been post-graduates and students of subjects other than science. I conjecture that if these lectures had been compulsory, there would have been an atmosphere of boredom which would have made them heavy going for lecturer and student. I would suggest that this can be avoided only by the help of talented and brilliant lecturers, which in this subject is at present almost impossible, or by attaching an inducement to study in the form of an examination having a real influence on the degree that the student will obtain.

The difficulty of teaching this subject is much greater than that of teaching science. The original documents of science are accessible, are in modern languages, require only one kind of reasoning, involve no understanding of human problems. The problems of teaching the history of science are, in fact, akin to those of teaching history. The original documents are largely inaccessible owing to their rarity and cost ; many are in Latin ; the understanding of the difficulties of the earlier scientists involves the comprehension of modes of thought utterly sundered from the scientific ; the story of even the simplest scientific discovery is, in fact, most complex. Generations of historians have surmounted such difficulties in their own subjects and have reduced the crude mass of historical evidence to a system of facts and principles easily understood by the student. The history of science has not yet been worked over and digested in such a manner as to make its facts and principles easily assimilable by the ordinary student, and this is a work for which the universities should provide the means.

The conclusion which I hope to have established is that the history of science is a subject for which universities should provide teachers, in the first instance so that the subject should be adequately investigated and significant conclusions reached. The subject is one which should form a part of the training of the history student, and may with advantage be studied by the science student. The best methods of teaching the history of science are at present still uncertain, and the special problem of presenting so complex and far-reaching a subject to undergraduates whose education has been on a narrow front is the hardest of them, and as yet unsolved.

SHOULD ASSISTANT LECTURERS BE TRAINED?

By Arnold Lloyd

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Life for an assistant lecturer is necessarily arduous because he has to fill two somewhat incompatible roles simultaneously: he is paid to teach but is looked on with disfavour if he does not himself show some aptitude for learning. As teaching is a new skill which may not come easily, while his research is inspired by a deep interest which makes drudgery worth while, he may be forgiven for regarding lectures as an unfortunate distraction from his major interest, something which must at best be done conscientiously but without enthusiasm. It is the purpose of this article to examine the demands made on the young lecturer by his dual role as teacher and student and to ask whether his teaching would not be more successful if during a brief preliminary course of training he were able to discuss the diverse problems of university teaching with the help of senior members of university staffs.

The demands made on a junior lecturer in his capacity as teacher are formidable. He has to prepare and deliver courses of lectures, he has to take his share in conducting small classes, he may have to give individual tutorials, he will have to mark essays, and will have to help in setting and marking examination papers, and if he is a scientist he may have to help with demonstrations and experiments. None of these activities is easy by itself and when undertaken simultaneously and without preparation they must be quite unnecessarily exhausting. Moreover the junior lecturer is often confronted by an audience of first-year men whose special needs would challenge the teaching skill of very experienced dons.

The lecturer's audience

Since our prime aim as university teachers is to help the student to study for himself and since the first-year man has qualities and defects peculiar to his youth, it may be useful to consider some of the characteristics of the junior lecturer's audience. Our first-year men were but a few months ago members of Sixth Forms in grammar schools, men who though grateful for the adult status we seem to confer on them when we address them as " Mr. Smith " or " Mr.

Jones", know very well that they lack that rapid and firm grip of essentials which seems to them to mark the adult mind. But if they lack experience of analysis and synthesis, they have qualities which make very great demands on those who teach them. They like learning for its own sake, they are interested in cause and effect, they look for connected reasoning and for principles. They come to us with minds prepared for relationship, meaning, coherence, development; they are interested in asking relevant questions and they expect their university work to train them in the successful pursuit and use of knowledge.

To be sure, they are liable to be intoxicated by " principles " which for the first time are felt to be interesting in themselves and a good deal more interesting than the facts they summarize. Indeed, herein lies a source of confusion for the young lecturer who may be deceived by the apparent fondness for rational argument shown by his students. Young students so much enjoy discussion that a mania for argument may well seem to be one of the most marked characteristics of youth, although a closer inspection of their dialectic usually reveals that logic is subordinate to the demands of emotion, in fact, that the conclusion conditions the premisses. While this suggests that too often students may conceivably be in some danger from lecturers who are skilled in persuasive speech, it may also serve to remind us of the place once occupied by a training in rhetoric, for centuries the coping stone of youthful education.

Constructing the lecture

The junior lecturer has then, as a major assignment, to prepare and deliver a course of lectures for young students who lack experience of academic work but who are interested and keen and who will respond readily to coherent and well-spoken lectures. What can he do to meet the challenge of his intelligent and expectant audience? He will do well to consider first, perhaps, the tragedy of ill-constructed and badly delivered lectures for the student in a civic university. For many students lectures are still the primary source of help, for it is from them that they gain most rapidly a firm grip of essentials and a guide to further reading. For this reason the young lecturer with a sense of responsibility will put aside the temptation to subordinate his teaching to his own research and will face the task of preparing and giving his lectures as his most important business. It is probably still necessary to make the point that in

lecturing one should be doing more than conveying technical knowledge, which could indeed be read in text-books or learned in a correspondence course. Lecturing survives not only because it is cheap and easy but because normal undergraduates, who are more sensitive than most adults to qualities of voice, gain a stimulus from the spoken word which is often lacking in print. Good lecturing is a means of providing continuous contact between the minds of the lecturer and of his students and from this contact undergraduates may gain that indefinable quality which we variously call style, or judgment, or insight. Thus the young lecturer is confronted by an audience who are looking for something more than new technical knowledge.

Nevertheless, the immediate aim of most lectures is the communication of organized technical knowledge and, remembering the fate of the unrecorded spoken word, which is almost completely lost within a month, both lecturer and student should co-operate to preserve what is worth keeping. The young lecturer should deal firmly with his audience from the beginning, disciplining the enthusiasts who aspire to the completeness of a verbatim report because they regard all lecturers as verbally inspired. Some students learn to write shorthand at 130 words a minute so as to record lectures in full, and some have even proposed to share the expense of employing a shorthand writer. Well-constructed lectures make allowance for the findings of psychologists who have studied listening and who would approve of well-placed connective tissue, which reporters can safely omit. Students who do not master shorthand try a variety of devices, ranging from longhand verbatim notes, which get most of the words but miss the sense, to those haphazard jottings of striking facts or expressions which within a week are meaningless.

In composing his lectures the novice may usefully bear in mind such points as the following. The total number of lectures, the length of each lecture and the extent of the field to be covered are data which he will ignore at his own peril and to the confusion of his students. He may find otherwise, as has happened to experienced lecturers, that, if for example he is a historian, he has spent so much time dealing with the regicides that the end of the session overtakes him at 1648 instead of 1688 !

In deciding the sequence of his lectures he may usefully ask himself, where his matter leaves him some choice of treatment, whether he

cannot do something better than lay down successive blocks of information on some principle of the additive accumulation of knowledge. Where his discipline permits of the organization of material it may be suggested that his students are more likely to learn to study successfully themselves if, at the end of a lecture course, they can see that the series has given them not only more technical information but knowledge which is more coherent, more impressed with form and meaning than when the course opened. It may be necessary to put in a caveat against using this plea as a justification for the ingenious selection and arrangement of facts which suit our private preconceptions !

Planning the course

Each lecture in a well-planned course should be felt by the student to be a necessary part of an intelligible sequence and should be carefully composed to make the best use of each lecture period. To do this successfully requires a good deal of practice but it is practice which repays well the time spent on it. Since neither the lecturer nor his students can afford to make a muddle of important lectures early on in a course, it may be suggested that the beginner should analyse a few printed lectures in his own field and indeed attend public university lectures in order to remind himself of the students' listening problems. With this practice to help him, he should prepare a verbatim lecture script. Unless he is unusually gifted in extempore speech the tyro would not be wise to rely on lecture headings only, and should compose a script which is word perfect, for all his attention will at first be needed to ensure a clear delivery, at a pace suited both to his students and to the room in which he has to lecture. It seems best to regard the lecture, in this respect, as a skilled performance towards the execution of which any help that may be forthcoming from the head of one's department or from the college speech-training experts should be welcomed. Indeed might it not be worth while for the university authorities to call in the experts of the B.B.C., who have unrivalled experience in reaching audiences effectually ?

Classes and tutorials

The preparation and delivery of lectures is but one half of the junior lecturer's teaching life. He often has in addition small classes and individual tutorials which make great demands on him. It is

tempting to regard such work as yet one more hindrance in the way of his research instead of a valuable element in his own training. Class-work and tutorials demand wider knowledge than is required for lecturing and when well done gives him a grasp of his subject which cannot be acquired otherwise. Just when he is most inclined to concentrate entirely on his special line this group and individual work helps him to maintain a wide interest and to consolidate his recently acquired knowledge.

The small class affords the young lecturer an opportunity of exercising upon individual students in a civic university a continuous influence which is the best equivalent a first-year man is likely to get for the careful personal instruction often given by tutors in the older universities. When they are well-run, small classes enable individual students to feel that their own abilities and interests are given scope while providing an opportunity for co-operative work in which each member shares in the accomplishment of a common undertaking. If he is not familiar already with the methods of study-group, organized discussion, and " pieces of work " advocated by Dr. Leavis, he should read *Education and the University** without delay.

Since the reading, marking, and returning of written work is likely to be a somewhat burdensome part of his work the lecturer would be wise to issue to his students a guide to written work. Some professors give out brief notes about the writing of essays, for example, with advice about subjects, length, sources, method and style. The marking of essays is so formidable a topic that it calls for an article to itself. As marking has such important consequences for our students and beyond them for the community, it seems reasonable to suggest that markers should be trained to mark justly and efficiently. It is well-known that for some examinations involving many hundreds of candidates a simple statistical check is used to ensure that the standard of marking does not change appreciably from hour to hour and young lecturers who will have to mark many essays or mathematical and scientific scripts in the years ahead will be better equipped for their work if they are taught marking techniques which help to eliminate subjective factors. It is a useful experience, for example, to correlate the marks given to a few dozen scripts by one lecturer with those awarded for the same papers by his colleagues, for the wide differences in assessment often reveal

* Chatto & Windus, 1951.

temperamental leniency or severity which, if uncorrected, may invalidate the marking.

Examinations

Since examination papers exercise a formative influence on so many students (however much we may deplore " the ready and confident superficiality " which they seem to encourage), it would be well if the apprentice-lecturer could be trained to compose questions which test real understanding rather than weigh masses of inert material. He can gain much help from the system in which all papers are examined in draft by a panel of three colleagues who, being free to discuss both topics and phrasing, can at least purge the paper of ambiguities and can often help in weightier matters as well. It is desirable that all scripts should be read by a second marker, for judgments of answers of the essay type are notoriously fluctuating and subjective. The need for guidance in marking is emphasized by the wide range of marks awarded by experienced examiners to the same scripts; there is on record one case in which the marks awarded to a paper ranged over seventeen grades out of the twenty-three used by the markers !

The fierce competition for university places has made it necessary to select by interview from among a large number of candidates who hold the minimum entrance qualification and the young lecturer is sometimes invited to share in this important work without any preliminary training. It is well-known that an unorganized interview is highly unreliable and unless carefully planned an interview is practically worthless as a means of selection. The conversation covers too small a field and judgments tend to be made upon such fallacious indications as manner, facial expression and personal appearance. Even trained investigators who are working to a predetermined list of qualities find it easier to agree on estimates of temperament than of character. It is desirable that interviews should be conducted by skilled interviewers, working under controlled conditions. The validity of ratings improves considerably when trained interviewers use carefully planned forms which include agreed assessments for essential qualities. At the risk of raising a smile one may perhaps mention testimonials which, in spite of the sceptics, are useful both to students and to employers when they are written objectively. This is not however the place to examine the many

factors affecting their validity which should be in the minds of young tutors who may have to draft them.

Two suggestions

This brief review of the range of work expected of a young lecturer prompts the present writer to offer two suggestions. There seems to be room for a short initiatory course at which a group of experienced lecturers, tutors and examiners discuss with young lecturers how they may best help their students. That such a course would be welcomed by the learners is clear from the ready response of some fifty young members of the staff at Nottingham University to a course of voluntary lectures offered by members of the Department of Education. (Indeed, it is the experience of this course which has prompted these reflections.) A second suggestion is made as a result of some experiments on the form and content of university lectures with a group of advanced students of experimental psychology who were investigating the effect on active listening of such distractions as emotive words, departure from the plan announced at the opening of the lecture and so on. As the lecture as a teaching method seems to have been very little studied in England, would it not be useful if the committee of Vice-Chancellors and Principals were to appoint a working-party to investigate this part of a junior lecturer's work ?

ORTEGA AND EDUCATION

By Edward Sarmiento

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Ortega's recent visit to this country prompts an attempt to reassess his thought on education, in particular, university education. There is the more interest in so doing since his influence is claimed in or on behalf of several experiments and it is not at all certain that in any of them have his ideas been very clearly understood.

A brief recapitulation of his main theses will enable us to examine some alleged applications of them.

In his study *The Mission of the University** Ortega makes a number of demands for the reform of the university which can be tabulated as follows:—

(1) that teacher and researcher, professional student and research student, should not be confused;

(2) that culture (in Ortega's own meaning of the word as, briefly, the interpretation of life) and research should be kept distinct in thought and practice;

(3) that the nucleus of the university should be a Faculty of Culture in which five disciplines should be taught not as research but as results;

(4) that a university pedagogy, a method of higher education, should be thought out and used;

(5) that for the new Faculty a new type of teacher should be found; an integrator of cultural ideas;

(6) all university teachers to be appointed for their teaching ability and not for their research achievements;

(7) that the university should be responsible for research *in addition* to its teaching functions; and

(8) which does not concern us here, that the university as such should participate in public life.

The exclusion of research from the ordinary undergraduate teaching of the university is a not unreasonable suggestion and certainly not uncalled for. This, the most practical of his requirements, is called in as the explanation of the present, new arrangement of the University of Madrid, though, be it noted, not by the

* *La misión de la universidad*, 1930; English translation by H. L. Nostrand, Princeton, 1944.

authorities of the University or of the Ministry of Education themselves. Nevertheless, there is probably something in the attribution. Briefly, the reorganization consists in the complete (and physical) separation of the University, installed in the handsome University City, restored after the destruction of the war, from a new research body, the Consejo Superior de Investigaciones Cientificas, which embraces arts and sciences, and is mainly concentrated on a handsome campus of its own in another part of Madrid, complete with residences for unmarried research workers and assistants. But the fact remains that the majority of the salaried research-workers are also engaged in university teaching. The result is that many complain of two things: the tedious journeys between their two places of work, and the disappearance (physical as well as symbolic) of the stimulus for undergraduates of research carried on within their sight. But Ortega never proposed anything like this. He says specifically that it is the university which must carry on research, a task it must perform *in addition* to its main teaching function, and he says moreover that it should be physically present to the undergraduate population.

A much more debatable requirement is the teaching or transmission of culture.

The meaning of culture

It is important for the understanding of Ortega's proposals to know what he means by culture and there is reason to suspect that he has been misunderstood here as in the matter of research.

He does not mean anthropological culture, culture as Mr. Eliot, for example, uses the word. Ortega refers to a purely intellectual yet not necessarily entirely conscious reality. He means the ideas actually explicit or the assumptions implicit in the behaviour of each new generation within the anthropological culture of Western Europe (or any other group for that matter). Ortega's proposal that the university should explore and expound these ideas by which its contemporaries successively in each generation actually live is not a proposal to elaborate a synthetic culture, as it were a new revelation or philosophy, as the translator of *The Mission of the University* appears to think. *It happens* that (in Ortega's opinion) the vital, governing ideas of our times are those involved in Physics, Biology, Sociology, History and Philosophy. But at another time they might be the ideas wrapped up in other subjects, and at any

time these ideas might be wrong, and within quite short periods of time they may change entirely. If we are to follow Ortega's thought beyond his suggestion for the reform of the university, we must examine what he has to say on values, which provides the closer parallel with Eliot's use of the word culture. It is true that Ortega speaks of integrating and systematizing knowledge, but it is for the purpose of reducing it to order and obviously the process may modify the component branches of knowledge. Whether his new type of integrator is likely to appear in sufficient numbers is another question. Certainly, in his own country there is at present a great movement of integration of science and philosophy, but this may have other causes. But Ortega's object in proposing the transmission of " cultural ideas " (in his use of the words) is to ensure that we shall not be led in the dark, and to reduce the numbers of the " mass man ".

It is possible to doubt whether what Ortega requires will really have the desired effect. His diagnosis is the rise of the mass man. His prescription is the education of the ruling class in the *idées directrices*. But (*a*) he did not foresee in 1930 the acceleration of socializing tendencies which tends to bring everyone (or no one) into the ruling class (*cf.* Eliot, who suggests that too many people are being educated at the university); (*b*) while it is true that our culture is being propelled by ideas which are not uniformly known throughout even its learned and active layer, ideas which are in conflict with the past and sometimes with one another and are quite out of reach of the mass, all that is not the only contributory cause of the crisis. Western culture has succumbed to a hypertrophy of its distinctive characteristic, the use of the function of logic and abstract reasoning, and it is suffering from a reaction; but underneath that again is the loss of any effective idea and apprehension of an absolute. Nothing could be better than to make effectively conscious, in the minds of those who can be educated, the determining ideas obscured in the jungle of knowledge. That it is the only way in which these ideas can be examined, evaluated and, if necessary (Ortega would say, inevitably), changed, is true. This is the function of his Faculty of Culture. But by itself it will not restore the wholeness or unity of culture. Nor will any mere retracing of steps. Here one may suitably consider Ortega together with the general trend, associated with the name of Sir Walter Moberly, among a certain number of university teachers. That Christian believers who are also university

teachers should, if they wish, meet to discuss their beliefs and their actions is no doubt excellent. It is possible that in so doing they may provoke a reaction on the part of those who are not Christians, and whether the resulting clash, if it comes, will be a good thing by any standards, remains to be seen. In this kind of discussion, also, there is a danger of religious discussion taking the shape of a recital of religious experience, but at least if this is so, and if it is a less good thing, it harms only the participants. What is clear is that it is not the mission of the university, nor even within its power outside its mission, to evangelize. That is the mission of the Church and the family.

It is sought to recover the unity of western culture. This is probably a utopian ideal. If the underlying ideas of the determining disciplines are exposed and pursued, no doubt a new unity could be achieved. The university can do no more than the first part.

How it is to do this has not yet been solved. Ortega requires a total reorganization by placing his Faculty of Culture at the centre of the university.

It does not seem that plans, on the American model, for " General Education " meet the need or that the concept of " General Education " approaches very nearly that of " culture " in Ortega's sense. From a study of *General Education in a Free Society* it is not altogether clear that this concept is not the same as culture in what Ortega calls the " ornamental " sense. Nearer home is the organization of the new University College of North Staffordshire. This is an interesting experiment and entirely worthy of being carried out, but there seems some misunderstanding concerning its relationship to Ortega's proposals.

Ortega's proposal a method not a plan

In May, 1950, Lord Lindsay described the organization of North Staffordshire to the Convocation of the University of London, and in referring to the plan of a general first year common to all students covering (i) History of Western Civilization, (ii) Democratic Institutions and (iii) Experimental Science, he is reported as going on to say that

> " this plan for the first year was the most distinctive feature of the new University College in North Staffordshire, although many experiments on those lines were being carried out in America, and Ortega y Gasset, in *The Mission of the University*,

> had advocated a similar scheme, maintaining that the business of the university was to teach its students how to be abreast of the ideas of the age by studying the heritage of Western civilization, modern democratic institutions and experimental science."

Ortega has not in fact specified these branches of knowledge, but others, chosen because, in his opinion, they happened to be the studies that controlled civilization at the time he spoke. And, of course, it is not claimed that there is any basic departure at Stoke approximating to the establishment of a central Faculty of Culture.

It is not very likely that Ortega's real proposals will be put into practice anywhere. Probably the nearest thing to Ortega's proposals is his own Instituto de Humanidades. This is purely private, extra-university, and at present hardly consists of more than a few courses of lectures in the evenings on fundamental topics of the day, accompanied by discussions. There is a small but enthusiastic public for this kind of thing in Madrid (some 300 people subscribed for a course by Sr. J. Marias last winter), and it is a kind of oral continuation of the old *Revista de Occidente*. It does precisely what Ortega wants a Faculty of Culture to do, but nothing that is not within the university is any real embodiment of his proposals.

This review of Ortega's proposals has brought up three distinct approaches to the problem of the cultural crisis. Ortega aims at making plain the ideas by which in fact we are living, he is concerned with the submergence of culture consequent upon the rise of the mass man. " General Educationists " aim at broadening not only the mental content of the modern technologist, but also of all who receive a modern university education, which is regarded by them as too narrow. Those with religion at heart desire to restore the esteem for Christianity in the universities and to ensure that " no student should go down without having been confronted by the Christian challenge ". All three of these aims are excellent, but it is doubtful whether any of these plans is the right solution. Ortega's is the most fundamental and should be seen in the context of his total philosophy, when it will be realized that it is only a first step. But it is also the most difficult to put into practice. Ortega fully realizes the limitations of the student but does not altogether appreciate the limitations of the university as a human institution. " General Education " is a fine thing, but its advocates overlook

the limitations of the student in precisely the way Ortega warns us not to overlook them. The deliberate attempt to restore religion in the university as such is neither likely to succeed nor to produce a diminution of the "cultural crisis". As a remedy for the crisis of the West it overlooks the limitations of the university as a function of society and ignores the essential factor in the situation, which is that society is post-Christian. Those who have religion at heart must preach at the street-corners, and work to prevent the disintegration of the family and to restore religion to the school.

In default of more spectacular remedies it seems desirable to inspect the situation and see what solution may be offered within the limits of the possible and the likely.

The limitation of the university

The recovery of cultural unity is of course a desirable ultimate goal but, as an immediate aim, it is not very realistic. So far as the university is concerned, the recovery of the religious component (rather than basis) of culture is not a proper function. If we understand culture in Ortega's sense, the university can only record that in fact the ideas by which contemporary man actually lives are divorced from religion and are of course undoubtedly altered by this very important fact of the absence of religion, but to say that it is a suitable task for the university to put religion back is to misconceive the meaning of all the terms—culture, university, religion—used. But Ortega can help us where the others fail us. Though his scheme of reform is out of reach he suggests a possibility in the microcosm of the individual. The one bond that knits all the members of the university together is the pursuit of truth. The recovery of confidence in the individual task of the pursuit of truth is the first step, and it is a possible one.

The university could be appreciably reformed tomorrow if tonight every university teacher made a rigorous examination of his academic conscience and resolved to focus his teaching matter in its context of the rest of knowledge, and to present it as far as possible in contact with his system of values, his apprehension of ultimates, or even, quite frankly, as a fragment in a chaos, if that is what he feels it to be. The student needs first the stimulus to constant thought and integration, and secondly the communication of the whole that life is. If, as university teachers, we cannot give him the second because we have not got it, at least let us give him the

first so that he may be put on the way to achieving the second for himself. We want students to learn facts, but they cannot learn all the facts; we want students to learn to think, but they need not — cannot — learn first to think and then to apply thought to " subjects ". In their several disciplines, the training to think is present, the whole of culture implied. We have lost the traditions, but in the study, even now, of any branch of knowledge is inherent the conviction that truth is supreme, that man pursues values, that life is a " given ", that for man the self-justification of values is a transcendent; and in the very act of teaching, in the broadest sense, is implicit the unity of mankind. This is not everything, but it is better than nothing. It is for the churches to revive Faith, which is strictly supernatural, and no part of the function of a university, and only the concerted action of individual believers can establish the society of the redeemed. When that is done we shall not, to be sure, recover the culture we have lost, but we shall discover a new culture: if it is not more brilliant than any we have ever had, it will at least be our own.

THE AGE OF RETIREMENT

By T. Knox-Shaw

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Thirty years ago there was no age of retirement for professors at Cambridge. They held office until they retired voluntarily or died in harness. There were men in those days full of mental vigour and still highly respected for their academic distinction long after they reached the age of sixty-five, while others lost grip of their subject, and departments had to wait for an infusion of new blood before becoming alive again. After the first World War the need for a general overhaul of the University's organization was urgent, and as one of the results of the Report of the Royal Commission on Oxford and Cambridge Universities new Statutes were introduced in 1926 fixing the age of retirement for professors and other university teaching officers at sixty-five. After considerable discussion Cambridge opted for no power of extension beyond that age. Oxford, on the other hand, took limited powers to continue in office holders of certain posts to the age of seventy. The age of sixty-five is the age which has been adopted by universities in general for all their teaching officers, except in Scotland, where some chairs can be held until the age of seventy.

Much has happened in the last thirty years, and if a Royal Commission were reporting now there are strong grounds for thinking that the age of sixty-five would come up for revision. (In this article I wish to mention some of the facts that have convinced me that a change is both necessary and desirable, in the hope that others far better qualified than I am will take up the issue. I have only experience of one university). Anyone who has seen graphs showing the percentage of the population in the various age-groups, based on the ten-yearly census, cannot fail to be struck by the startling increase in the age-groups above sixty-five. The projections made by statisticians to show future trends are even more impressive. It is clear that, unless an intolerable burden is to be placed on the shoulders of the working population in an attempt to support the ever increasing number of those in retirement, all who are fit and able to work after the age of sixty-five should be encouraged to do so. The economic state of the country now is such that it cannot afford to keep a large percentage of its population

unproductive. Since this applies to the country as a whole, the universities should lead the way and show that efficiency need not suffer by prolonging the active life of a don or of a laboratory assistant.

It is hardly necessary to point out how this change has come about. Owing to advances in science and medicine people have a longer expectation of life and are on the whole fitter in middle age than their fore-fathers at the beginning of this century. The mere fact that people are living longer is a sign of greater vitality and capacity for work over an extended period of employment. The mention of period of employment leads to my second point.

What is the appropriate age?

At the present time the majority of men are entering on their careers two years older than in pre-war days because of national service. In consequence their period of active work in the field of their choice will be cut short by two years unless the retiring age is extended. Whether there will be the same need in the future for calling on each generation to devote time to military training remains to be seen. For the present generation it is a fact that should be taken into account.

It is said that to prolong the tenure of offices blocks promotion. For a very short period that might be true, but in the long run all would benefit. Surely those who but for national service would have started two years earlier as lecturers would like to know that they can look forward to holding their posts for a longer period, and, even if they do have to wait a little longer for a chair to fall vacant, they would, if elected, hold it for the same length of time as at present. For those who had long war service and had to postpone entering on their university career until long after the normal age, the prospect of spending more years on academical work on full pay would be welcomed.

If a change is made, should there be a fixed age of retirement, or should universities take precautions against the premature ageing of certain individuals and seek powers of extension? From the point of view of the administrator there is the attraction in the flexibility that the power of extension gives. In theory each case can be treated on its merits. But in practice a great deal of heartburning and resentment can be caused if Professor X is allowed to remain in office and not Professor Y. It is difficult for any body of men

competent to make such decisions not to be influenced by personal relationships among colleagues.

There is also the position of the man about to reach the age of sixty-five. He wants to know well in advance whether he is to be continued in office or not. If he retires, he may on financial grounds be compelled to move into a smaller house. In pre-war days anyone at short notice could find suitable accommodation. It is not so now. Some considerable length of time, possibly as much as two years, ought to be allowed him to search for a home in which to retire, if a change is essential. Will universities want to make so long a time ahead the decision on which so much depends? No one ought to be placed in the position of trying to find out in advance by personal contacts what his chances are of further extension, and yet some may feel compelled to do so for the sake of their families. Is it not far kinder to the individual to let him know that he will be vacating his job on a known date?

What is that date to be? At the end of the academical year in which he reached the age of sixty-seven, sixty-eight or seventy? There is bound to be difference of opinion on this point, and for the sake of argument I will put up the figure of sixty-eight. I have chosen it for a variety of reasons. It was considered, I am led to believe, by the members of the Royal Commission thirty years ago as a compromise between those who wanted seventy and those who preferred sixty-five, before finally deciding to recommend the age of sixty-five. Any change to be generally acceptable should not be too drastic. For that reason three years is preferable to five, and some may favour two instead of three. It may well be that in years to come seventy may be selected as the age for retirement, and in the meantime sixty-eight may be acceptable for a trial period.

Some consequences of an extension

An extension of three years would, I think, be welcomed by most university teachers, while the prospect of being expected to carry on for a further five years might cause some misgivings. Some may feel that they could give good service to the university and their pupils for the shorter period and have doubts about the longer. Under the existing Regulations any one can retire at any time after reaching the age of sixty and this option would remain, but it is only a very small minority who do decide to give up their teaching before they are required to do so by Statute.

The transitionary period, during which the expected number of senior posts would not fall vacant, would be limited to three years, and thereafter the normal flow of retirements on reaching the age of retirement would operate. In three years there is less likely to be that deterioration in efficiency that is one of the main arguments for making no change. Judging from my knowledge of those who have retired recently I would say that the majority, if not all, were well able to carry on effectively for a few more years. There always will be exceptions whatever limit is set for the age of retirement.

I believe that the efficiency of a great many professors and lecturers would be increased by the knowledge that their earning capacity is to be lengthened by three years. They are worried now by the prospect of how they are to meet their commitments when they retire. By remaining in the Federated Superannuation System of Universities for an additional three years a marked difference is made in the pension. There will have been three more years of accumulation and a reduction of three years in the expectation of life. The pension problem is acute, and one way of alleviating it would be by raising the age of retirement. To give some idea of the improvement in a pension obtainable under the F.S.S.U. I will quote my own case. If I retire at age sixty-eight, I can get an annuity 23 per cent. higher, and at seventy an annuity 57 per cent. higher than at age sixty-five. If the pension was the only consideration, my example is an argument in favour of the age limit of seventy.

There are ways that are worth exploring by which the load of work could be lightened with a corresponding reduction in stipend for those who wish to be relieved of part of their work during the last three years of their tenure of office. For instance, a professor may find the heavy responsibilities of the administration of a large department getting more and more irksome. A great deal of that work could be handed over to a junior in his department with the additional advantage that there would be some one in the department fully cognisant of all the details of its administration when a new professor takes over.

It would not be difficult to arrange for lecturers to be relieved of part of their teaching, if they so desired, so as to make the change between full employment and retirement less abrupt. Let it not be thought for a moment that scholars forsake their subject of study as soon as they retire. Many welcome the freedom from formal

teaching which retirement brings, so that more time can be spent on writing or other types of research. The points I have been trying to make are that men and women at the age of sixty-eight still have many years of useful work before them because they have a longer expectation of life than in former times, and that it would be an advantage and not a hardship to them to expect them to continue in harness until that age. There is no justification for assuming that academic work would suffer if all members of the teaching and assistant staff continued their period of service for an additional three years.

Others may have ideas which differ fundamentally from mine. If that is so let their proposals be the subject of further articles on this subject, so that the action taken may be most beneficial to all parties concerned. My plea is that some action should be taken soon.

GRADUATE WORK IN PHILOSOPHY AT OXFORD

By Gilbert Ryle

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It was, effectively, only during and after the first world war that Oxford made any organized provision for post-graduate work in philosophy. An Oxford graduate who hoped to become a teacher of philosophy was expected either to step into a teaching post immediately after completing his Final Honour School or else to study abroad for the doctorate of some continental university. Apparently, in the years before that war, few graduates of overseas or other universities in the British Isles came to Oxford in order to study philosophy, save those who were ready to read for the Honours Degree of Litterae Humaniores.

In 1917–18, it was made possible for graduates to get a D.Phil. in, among other subjects, philosophy. A candidate for this degree had to submit a thesis; his instruction and stimulation were supplied by an appointed supervisor; his final success or failure was determined by a pair of examiners appointed *ad hominem*.

Problems of the D.Phil.

For some time it remained rather a rare thing for an Oxford graduate to be a candidate for either the longer established B.Litt. or the new D.Phil.; and even graduates from other universities were strongly pressed to study instead either for Litt. Hum. or for P.P.E. Such candidates as did exist tended to have little in common with one another, since their thesis-subjects were apt not to coincide or converge. With a few notable exceptions, advanced classes in philosophy or philosophical scholarship were not provided and the lectures on the philosophy lecture-list were almost exclusively those necessary or useful for undergraduates reading for Final Honour Schools.

Fears lest the Oxford D.Phil. should become a cheap and easy qualification so influenced both the shaping of the rules governing the degree and the customary standards of the examiners, that a candidate was known to be courting disaster if he ventured to submit a thesis on any subject save one in the byways of the history or

scholarship of philosophy. Only here was there a good chance of a candidate making, within two or three years of graduation, a contribution to thought or knowledge which could be adjudged fit for publication. In the critical exegesis of peripheral philosophical works it was possible for a candidate to show knowledge and understanding of what no one else had bothered to study.

In the 1930s the position changed in various ways. It became so untempting and unrewarding for British or American graduates to go to sit at the feet of continental philosophers, that the graduate-stream swung towards Oxford and Cambridge. The increasing rigours of the study of ancient history and of economics made it less reasonable to advise graduates from other universities to get their philosophical training by reading for one of the Final Honour Schools. The large expansion of the Philosophy Sub-Faculty (due to the creation and growth of the P.P.E. School), together with the working of certain intellectual ferments in its members, resulted in the offering of lectures and seminar-instruction on philosophical and logical topics which were off the tracks beaten by the Examination Regulations of the two Final Honour Schools. The customers were there, the producers were there, the commodities were there. Only the market-place was lacking.

In the late 1930s teachers of philosophy in Oxford were becoming well aware of what was wrong with the fetish of " research-work in philosophy ". Solitary composition of a carefully circumscribed thesis on a fringe-topic in, usually, the history of philosophy was seen to be a poor training for a future philosopher or teacher of philosophy.

Creation of the B.Phil.

Immediately after the last war, therefore, a new project was launched and was accepted by the University. In addition to the existing B.Litt. and D.Phil. degrees, the new degree of B.Phil. was created. It is not restricted to philosophy, since graduate students of economics, politics and classical languages and literature can also be candidates for the B.Phil. in those subjects.

The general scheme of the B.Phil. in philosophy is this. All the candidates of a given year are examined together by a single board of examiners, which has partial identity of composition with the boards of the preceding and succeeding years. Each candidate submits a short thesis, of not more than 30,000 words, on any

subject in philosophy or in the history of philosophy that he chooses, given that his thesis-title has been previously approved. He also sits three examination papers, of which one must be an historical one about some important philosopher or school of philosophy, ancient, medieval or modern, selected by himself. His other two papers are chosen by him out of (1) Logic and Scientific Method; (2) Metaphysics and Theory of Knowledge; (3) Ethics, with Aesthetics and Philosophy of Religion; (4) Political Philosophy, with Philosophy of History and Philosophy of Law. His thesis need not be adjudged worthy of publication as it stands, and can therefore be an essay, with no pretentions to exhaustiveness or finality, in a major philosophical issue or in the interpretation and criticism of a major philosopher. It need not play safe by being an industrious treatment of a parochial theme.

It follows from these requirements that every candidate in working for his B.Phil. is doing some joint work with a good many of his contemporaries; while he is also engaged in a piece of moderately substantial independent writing on a subject which may or may not have affinities with the subject of any of theirs. There is naturally some tendency for their thesis-subjects to converge, from different angles, upon some of the burning issues of contemporary philosophy.

It follows, too, that there exists a demand for discussion-classes on most of the dominant issues in philosophy and logical theory, as well as on those stretches in the history of philosophy from Plato to, say, the early twentieth century which are most frequently chosen. The philosophy teachers now have trained and critical audiences on whom to try out their own philosophical ideas or the results of their own historical researches.

Each B.Phil. student is thus kept in at least cross-table touch with a fair number of the forty or fifty Oxford teachers of philosophy, instead of being merely the protégé of a single supervisor. There is, however, some substance in the complaint that graduates from universities which provide little or no individual tuition need, at least in the first of their two years' work for the B.Phil., more of the tutor-pupil drill than is at present officially provided for them.

It is a natural and intended result of the system, that the B.Phil., B.Litt. and D.Phil. students confabulate frequently and vigorously together. They are the critics, instructors, irritants and allies of one another. Hailing, as they do, in changing proportions, from Oxford, other universities in the British Isles, the Dominions and the United

States, they put into the common melting pot a stimulating variety of philosophical doctrines, techniques and vocabularies.

Standards : the future

The examiners for the B.Phil. work to the standard that they could recommend a successful candidate for a teaching post in philosophy at a university. There is, in consequence, a fair number of unsuccessful candidates for the degree. Some promising candidates are admitted to the course, whose promise fades out early; and some candidates have to be accepted merely on the basis of examination-results and testimonials from universities where the philosophical standards are amateurish. Attempts are now being made to divert into safer channels some of the candidates who, after two or three terms, do not look like making the grade.

Can the successful products of this new and large graduate school of philosophy be sure of securing teaching posts in the subject? The answer is (1) that they cannot be sure of it; (2) that hitherto the great majority of able and suitable products have in fact secured temporary or permanent posts; but (3) that it is to be expected that the supply of would-be teachers of philosophy from Oxford alone will very soon considerably exceed the demand.

IDLE TALK—OR VITAL TALK

By Albert S. Schenkman

Lately Teaching Fellow in General Education, Harvard University

An informed world opinion is a necessity. But it is easier to speak about such than to bring it about. We cannot blind ourselves to the fact that in almost every country there are powerful forces which resent and prevent too great a diffusion of information. And we must realize also that to-day, in many parts of the globe, there are great numbers of distracting elements which often work against informed mass opinion.

But how can we improve the situation? How can we help in producing the "informed world opinion that will lead to international action"? First, let it be said at once (as Whitehead said it) that a "merely well-informed man is the most useless bore on God's earth". It will take more than merely well-informed men to bring about world-saving international action. The problem is rather how to find again a type of citizen who is socially responsible as well as factually informed. It is our thesis that this can be done only by using new methods of teaching.

Society, with its old methods of "educating", has inoculated us against the excitement and romance of true adventure stories, of stories such as that of the Impact of Science on our lives or of Energy in the Service of Man. To quote a distinguished American professor—"The child has a great amount of native curiosity. A great amount of education can knock this out of him!" The usual methods of teaching dull the mental powers.

By the time the average American youngster is sixteen, he has been taught (or so the results would indicate) to have no use for Shakespeare, for algebra and for geography. (List incomplete.) By the time the average Danish or Dutch youngster is eighteen, he has been crammed with so much of the best knowledge that "it quite overflows". It is only the less formal education of life itself that counteracts, to some extent, the apathy often produced by the "over-education" which is so common in our Western schools—in Western schools, incidentally, which may be located in the East.

The traditional method used by teachers—"assign, study, recite, and test"—usually has the results which by now are also traditional

—apathy, disinterestedness, narrow-mindedness and (often) merely factual information. These results are found at all levels and at all ages. Results follow methods almost as regularly as day follows night. This is true of " discussion groups " where the " leader " plans every detail. It is also true of primary school classes where the " teacher " can tolerate no expression of honest opinion which might be a threat to his authority.

But there are more modern methods of education—modern and new, and at the same time very old, too. There are the attempts to apply " learner-centred procedures ". These largely give up the attempt to teach, and attempt instead to create conditions which facilitate learning. This is a very different thing. When such conditions are achieved, " when the leader is genuinely a catalyst ", as a Chicago professor writes, " and not a mentor, the group shows remarkable capacity for coming to grips with the real issues, for self-initiated learning, for intellectual and emotional growth ".

From this point of view it is as important to develop in students (or, to write more accurately, in the " members " of discussion groups) attitudes and appreciations as well as understandings. These learning experiences are different from but just as important as the more factual types of learnings usually worked for. In other words, to produce a true group spirit, to make members of a group come to learn the pleasure and satisfaction of doing something as part of a group effort—this truly would be expending energy in the service of man !

We must be more specific and give prescriptions. Perhaps the first thing we must do if we are to have " conditions which facilitate learning " is to give students or members of discussion groups the right of self-determination. This is not to say that there must be no planning or advising from above. The opposite is more nearly the case. To use an example: the 1950 UNESCO discussion theme " Energy in the Service of Man " was new to almost all the groups that tackled it. Since it would have been too much to expect them to grasp its scope sufficiently well to plan the complete programme of investigation—small individual phases, yes, but not the over-all plan—UNESCO did well to break down the theme into several major sections.

Another important requirement is that groups be asked to discuss not simply for the sake of discussing, but that they have some definite responsibility to society. Some way must be found of

developing a sense of group responsibility which transcends small communities (the discussion groups or college classes) and includes ever larger bodies. The different organizations tackling this, or another problem, might be asked to report their findings to the UNESCO National Commission or to bodies of similar types (national congressional or parliamentary committees, etc.). Learning for the sake of learning has lost much of its fascination in this twentieth century.

The Harvard "workshop" experiment

Our points will be made stronger if we illustrate by referring to a particular experiment with which we are well acquainted. In the Spring of 1949 and also in 1950 "workshops" were conducted in connection with a Harvard College General Education course, "The Impact of Science on Modern Life". The writer planned and organized these workshops (small groups of students concentrating their discussions on certain specified special fields). They were designed to supplement, or complement, some very popular lectures in a college course, mostly given by Professor Kirtley F. Mather, the President of the American Association for the Advancement of Science. As already pointed out in the UNIVERSITIES QUARTERLY*, a student who elected to join one of the groups came up against not only the impact of science on one special field but against issues of the day (the impact of science on medicine and public health, the social responsibility of the scientist, international collaboration in scientific projects, etc.).

The writer attended the scheduled two-hour meetings of all the groups but served more as an Executive Secretary than as a traditional "leader". He tried to be a "catalyst" and not a mentor. The workshops were student-run, and the groups made group decisions.

President Conant of Harvard, in his *President's Report*, 1950–51, comments with keen insight about the experiences which educate: "Centuries of academic history have shown that it is not primarily through the curriculum that a student learns a worthwhile way of life. Tolerance, honesty, intellectual integrity, courage, friendliness, are virtues not to be learned out of a printed volume but from the book of experience; and the content of this book for a youth is

* Vol. 5, 3 (May 1951), pp. 258–268. (A more complete account of this "Experiment in General Education" will be found in the *Universities Review*, February, 1952).

largely determined by the mode of his association with contemporaries." We are convinced that the workshops made a contribution towards the development of " those attitudes so essential for the survival of a modern democracy " (which Conant lists as " co-operation, humility, respect for the will of the majority, loyalty, and political leadership ").

Energy in the service of man

But nothing in its nature rules out the use of the workshop method in a non-academic environment. The antithesis between the academic and the non-academic is more artificial than real. The workship device is applicable to all sorts of adult groups. Did not a former Master of Balliol once say, incidentally, that 25 per cent. of the essays written by tutorial class members of the Workers' Educational Association were as good as the work done by men who obtained First Class Honours in the Final School of Modern History at Oxford ?

Turning now specifically to the " Energy in the Service of Man " UNESCO theme to further illustrate. Here is a topic that was discussed at many levels, academic and non-academic, popular and semi-popular, and throughout the world. UNESCO broke down the theme into six divisions—such as Utilization of Energy, Energy in its International Aspects, the Role of Energy in Underdeveloped Areas, etc. What are the possibilities of a " workshop " discussion technique with such subjects ? The device is ideal.

Workshops could be given titles corresponding to some of these subjects. In every case, however, the different groups must have the right to conduct their business in their own ways. The members of the groups must be empowered to determine their own destiny.

There can, of course, be no one-two-three prescription for engendering enthusiasm. This is a process that depends—as does indeed so much of the success of a true discussion group—very largely on the personality of the organizer and on his entire approach. Sincerity is as important an ingredient as can be listed. It is also important, as already stated, that the group be made to feel that they are doing something which has real value, that their results will be *used.*

It is axiomatic that the " best " methods can be complete failures in the hands of poor leaders, of persons who cannot resist leading too much. As we conceive it, the ideal group leader must be more

the " catalyst " type of person than anything else. There is no point in making a list of " necessary qualifications ". Actually, there is a great deal of truth in the remark that " that leader is best who leads least ". And yet the ideal discussion group leader is always at hand to take over if need be.

Regardless of the size, it is imperative that the group have opportunity to discuss with and to question experts on their particular topic. Such an outside stimulus is necessary to spark the discussion, to bring new ideas to the members, and to keep the group from working in a vacuum.

It should be understood that we use the term *expert* here to designate not necessarily a world authority on the subject but, perhaps, only a person who has more than the usual amount of first-hand information about a section of the over-all theme. By this definition a " member " of one workshop might be an " expert " if he met with another group. Often merely the presence of a new face does much to liven discussion. If nothing more, new contacts always serve to strengthen group members in the knowledge that they are not alone, and meeting with outside people convinces them that they are not carrying out abstract—and meaningless—discussion.

Cross-pollination between different workshops is a method that should be used wherever possible to increase the vigour of the discussion stock. This is so obviously feasible in the case of workshops set up by the same organization that we do not need to stress the point. The members of one workshop will naturally want to learn the conclusions of a sister body. But there is no reason why there could not be exchanges of ideas between workshops of *different* organizations—both of the same country and of neighbouring countries. Members of a college class or workshop on an " Energy " topic, for instance, could meet with a workshop discussion group of a labour union or of a women's club. And *vice versa*, members of such a labour organization or club could be invited to appear at meetings of scientific societies studying one of the subdivisions of the topic; etc. The exchanges that could be worked out are numberless. Why does UNESCO not take the lead in establishing liaison *methods*? Final decision as to whom to invite must, of course, be left in the hands of the individual groups. (Needless to say, exchanges of " experts " between countries is not always simple to arrange; but it ought always to be worked for.)

In closing, we must point out explicitly that a certain amount of freedom is the essence of the workshop method. For precisely this reason we have been very careful about not spelling out too many workshop rules and regulations. Education is a process and a growth and there is no such thing as a crystallized " workshop device ". (Crystallized systems are not questioned. The lecture system, for instance, has for a long time been assumed to be *the* educational system and too rarely is it examined critically.) Those who use the workshop method should continually attempt to improve, to perfect, the device—in the full recognition of the fact that it will always need perfecting and that it will always be subject to improvement.

There is one final point that must be made. It is not an abstract sort of freedom that produces the incentives of the workshop system (and causes some of its faults as well). The freedom of workshop members—in organizing their discussion topics, etc.—must be combined with a definite responsibility on the part of these members to society. There must be a concrete " freedom to be useful "—though, to be sure, every person must use his freedom in deciding how he wants to go about being useful. " Learning for the sake of learning has lost much of its fascination in this twentieth century." So, too, freedom for the sake of freedom alone has lost its fascination. Our solution was—and is—that the different groups tackling important topics should be asked to report their findings to the public and that these findings be made use of.

TECHNICIANS AND THE UNIVERSITIES

By Raymond Whitehead

Reader in Pathology, University of Manchester

Members of the scientific professions need a variety of skilled assistants. In medicine these are known as auxiliaries; there are about twenty distinct types, each with at least one professional association. The position seems to be similar in electrical engineering, although the various types of assistant are less clearly differentiated and less well organized. In both medicine and electrical engineering, one of the main auxiliaries is the laboratory assistant or technician—a man skilled in routine work not requiring the complete professional training of the doctor or electrical engineer. Details are given in two important documents published in 1951 : *Reports of the Committees on Medical Auxiliaries* (H.M. Stationery Office) and *The Education and Training of Electrical Technicians* (The Institution of Electrical Engineers).

Universities are but one of many kinds of organization concerned with technicians, but as educational institutions they have special responsibilities. The problems facing universities in this matter are numerous and difficult, and it may be helpful to review them. Two main conclusions may be stated here. The first is that the educational problems of the technician are essentially the same whatever profession he serves, hence educationists in different professions can usefully confer. The second conclusion is that universities could learn much from industry's vast experience in the training and management of young people.

For obvious reasons I deal here only with medical laboratory technicians—those who assist pathologists and bacteriologists in universities and hospitals. No better example could be chosen, for they are the oldest and best organized group of technicians, with a professional association founded forty years ago. Experience of their problems is now great and would be helpful to those concerned with technicians in other fields.

Technician apprentices in universities

The training of medical laboratory technicians is undertaken chiefly by hospitals and by university departments of pathology and bacteriology. The school-leaver becomes an employee of the

hospital or university, and normally holds one of the recognized certificates of general education. He learns the job by doing it under supervision, continuing the study of chemistry, physics and mathematics at a night school for about two years. At the end of this period, towards the age of nineteen, he has enough technical experience and scientific knowledge to profit from formal courses of instruction in medical laboratory technology. On completing three years of technical work he can take his first professional examination (intermediate) covering the whole subject at an elementary level. Two years later he can take the final, which is specialized, and so become an associate of the Institute of Medical Laboratory Technology.

The training is of the same nature in hospitals and universities. Large hospitals give a complete training of good quality in all branches; small hospitals cover the same ground, but naturally cannot offer the same wealth of experience. University departments are usually specialized; university technicians thus get trained up to a high standard in one branch, but have to learn the others as best they can. Universities help their technicians by allowing them to attend approved day courses, for which they pay the fees if attendance is satisfactory, but it is not customary for a university to accept any official responsibility for the education or training of the technicians it employs. Unlike university students, who have deans and tutors to guide them, technicians are left to fend for themselves. They are in greater need of guidance than students; they want advice not only on their studies but also on such matters as deferment of national service. Help is given by pathologists and senior technicians, but their advice is often contradictory and based on imperfect knowledge. In these circumstances it is remarkable what a success most technicians ultimately make of their careers, though in some cases with much waste of time and effort in the process.

A variety of problems thus need the attention of universities; all these problems could be solved with some effort and a willingness to adopt a common policy. Universities should agree not to accept for technical training any boy or girl below the minimum standard of education fixed by the Institute of Medical Laboratory Technology (the old School Certificate). Acceptance of trainees below this standard causes endless trouble. Although they become competent technicians, they are ineligible for professional examinations. Some try to complete their general education by night school work in

addition to studying technical subjects—at considerable risk to health and efficiency; other refuse and become discontented.

In accepting a trainee, a university should undertake to give him a complete training, like that given in hospitals. The trainee should be engaged by an individual department, as at present, but should be required to work for prescribed periods in all the other appropriate departments of the university. Unofficial seconding from one university department to another has not been a success; it is too dependent on departmental convenience, which is apt to override educational considerations. An official scheme prescribed by the university is indispensable; only thus can universities be made as efficient educationally as large hospitals.

Full records of each trainee's ordinary work should be kept and be officially reviewed at regular intervals. Ultimately a standard form of student's record might be evolved for all medical laboratory technicians, wherever trained; this would be invaluable in determining fitness for admission to examinations.

The best plan would be for each university to set up a standing committee on the education and training of its medical laboratory technicians; this would naturally include the heads of all the departments employing such technicians. It would also be helpful to appoint a pathologist as the education officer for medical laboratory technicians, corresponding in status and functions to the tutor of a university faculty. The education officer could be the custodian of trainees' records and act as secretary to the committee. There is a great demand for the services of such an officer, not only to deal with the problems of the university's own technicians and prospective technicians, but also to advise pathologists of the region on the intricacies of technical education.

To get a complete training, university technicians would in some cases have to be seconded to the laboratories of other employers—hospitals, blood banks, public health laboratories or industrial firms. In return, universities should be willing to accept trainees from these for suitable periods. A regional arrangement is therefore desirable, and all concerned would gain by the formation of a committee representing all employers of medical laboratory technicians in the region.

Large engineering firms make excellent arrangements for the training and supervision of their apprentices, and universities could profitably study their educational organization and practice.

Universities and courses for technicians

Besides providing for its own trainees, a university has a general responsibility for the education of technicians in its region. Experience suggests that direct help is best confined to allowing the use of university classrooms, and that further help—no less important—is most easily given indirectly.

In this country, opinion is strongly in favour of maintaining the traditional system of informal apprenticeship for medical laboratory technicians. There is no appreciable demand for university degree courses in their field of work; since the essential qualification of a technician is practical skill, the taking of a degree would not necessarily be an advantage. It is generally agreed that systematic instruction for technicians is desirable. Courses have been given unofficially for years; they are now on a sounder basis, being arranged and financed in many centres by local education authorities under the Education Act, 1944. All concerned recognize that it would be best if courses could be given during working hours, since evening classes after a full day's work impose a considerable strain on teachers and students. Unfortunately, neither teachers, students nor classrooms are free during the day.

The giving of university courses and diplomas for technicians has often been discussed, and the conclusions are worth noting. It is usual for university teachers in any subject to prepare the syllabus and conduct the examinations; in other words the teachers assume complete responsibility for the courses they give. They desire—and ought to have—freedom to modify the courses as they think best. Under pressure, universities have sometimes given courses on the syllabus of an external authority. The objections to this are that the teachers have no control over the syllabus and have to teach subjects they consider undesirable, or in a degree of detail they think unnecessary, for the object in view. Departure from instructions (in the student's best interests) would mean refusal of the external authority to recognize the courses. One such arrangement (not for technicians) was soon terminated. A request for university courses for technicians was recently refused because the university was not to be allowed to influence the syllabus.

Even if universities gave courses for technicians, there would be serious practical difficulties in organizing them. Technicians are harder to teach than university students owing to the much greater variation in their educational background. Some could matriculate,

but most could not, and there is also much variation in the standard of scientific knowledge they attain after completing their general education—at school or night school. The teacher therefore has to adapt his methods and syllabus to each individual group of students; adjustments have to be made rapidly—within a matter of days. The organizers must also be empowered to engage or discharge teachers at short notice. Such speed is unknown—because unnecessary—in the ordinary business of a university. To be successful, teachers of technicians and the organizers of courses must have an exceptional degree of authority and independence; it is doubtful whether the requisite powers could be conferred by any agency but a local education authority.

As for diplomas, it is generally agreed that a certificate granted by a national professional body is preferable to a local diploma, and it is most unlikely that any university would agree to institute diplomas with the same object as those awarded by the technicians' professional body.

Since the function of technicians is to assist pathologists, it is important for pathologists to take part in the teaching; this ensures that the students know exactly what is expected of them in practice; pathologists should also teach the principles of their own subjects, so far as they are necessary for intelligent technical work. Much of the detailed instruction, especially practical, is best given by senior technicians, who have much greater experience of technical practice than most pathologists. In organizing and managing courses, technicians need the help of pathologists; many administrative matters can be handled more easily and effectively by pathologists than by technicians.

A scheme fulfilling all requirements was started in Manchester in 1949. The courses are run by an independent organizing committee of pathologists and technicians. The committee includes all the teachers in charge of courses; it prepares the syllabuses, supervises the teaching, and chooses the teachers. The College of Technology registers students, collects fees, and pays the teachers, acting for the city education committee. The classes are held at the university, but leave to use other premises in addition would be sought if the need arose. The Manchester scheme has been adopted in Sheffield, the arrangements being virtually identical. Under such a scheme, the role of the university is twofold; officially it allows its classrooms to be used for the teaching; unofficially it

supports the work by encouraging its senior pathologists and technicians to participate in the administration and teaching. In this way, all the difficulties that official relations with an outside professional body might entail are avoided, and the teachers and organizers have all the freedom they desire.

Amenities for university technicians

Technicians need the same facilities as university students and teaching staff. These include a refectory or canteen, health service, and opportunities for games and other physical exercises. These needs are generally recognized. Where there are many workers, as in universities and large commercial firms, the question of organizing recreational activities arises. In universities such matters are coming to be handled by a staff officer, whose function it is to promote the general interests of the technical and service staff. This is a very recent development in university life and still in the experimental stage; the experience of staff officers will be of great interest and should be published in due course.

The outside activities of technicians vary enormously and can be broadly described as those of the general public, varying of course with age and sex. The group of greatest interest is that aged 16–21. The outstanding fact is that night school and private study leave such technicians with small leisure; what spare time they have is largely devoted either to private recreations such as stamp-collecting or photography, or to work showing awareness of social obligation, such as help with boy scouts or cadets.

The outside loyalties of technicians are much stronger than those arising within the university. Like other people, technicians usually see enough of their associates during working hours and prefer fresh faces when off duty. Many technicians do not want anyone to arrange activities for them, and the whole question needs approaching with restraint and an open mind. It would clearly be wrong to weaken ties with the outside world, especially when these ties are due to the young people's own initiative. It would be best to limit organizing to special cases, and even then it would be better for technicians to do it themselves. As for social functions, formal academic receptions appeal chiefly to older people and most technicians would much prefer a hot-pot supper.

The spontaneous interests of young people, especially when they do any necessary organizing, are of much greater value than any-

thing that could be arranged by a benevolent official. On the other hand, general conditions of work are of great interest to technicians, and a staff officer is on safe ground when dealing with these. He can also investigate and possibly remedy discontent, and study the changes of occupation that technicians sometimes make; the information would be a useful contribution to social science and should be published.

As suggested above, the education officer for technicians should be a pathologist—no one else has the requisite knowledge of technicians and their work—but he would constantly need the assistance of the lay staff officer, who has his own distinctive training and experience.

Salaries of university technicians

In 1944 the Goodenough committee on medical schools noted the keen competition for the services of medical laboratory technicians. It recommended the adoption of a national scale of salaries and superannuation by all employers. The committee thought that this would make it easier for universities to recruit and retain technical staff, and to maintain the necessary standard of work. The introduction, four years later, of the National Health Service largely met the committee's wish: standard rates (the Whitley scale) now apply to all technicians employed by hospital management committees, the Public Health Laboratory Service, and many teaching hospitals and universities; at least 70 per cent. of medical laboratory technicians seem to be on the Whitley scale. Unhappily, many such technicians in university laboratories are still paid at lower rates than those in hospitals. The nature of their work is exactly the same, and university technicians sometimes do their work in hospital laboratories whose own staff are of course paid at the standard rates.

As a result, nearly every underpaid university technician sooner or later takes a hospital job. There is no difficulty in getting one; university technicians are welcomed, and they can move at their own convenience. If they wish, they can often get a hospital job in two to four weeks, but if they want to work in a particular hospital they may have to wait longer. Certain hospital laboratories are widely known for their interest in technicians; vacancies in these are rare, and there is keen competition for them. These hospitals naturally skim the cream of technical ability, and university technicians are

content to wait a year or more to gain admission. Transfers are especially common at the age of 18–22, when the financial advantage is first clearly appreciated.

This continual loss of technical staff is a serious embarrassment to university laboratories. The technicians who remain have far too much to do; research and routine work are delayed and the standard of efficiency lowered. In short, the work of the medical staff is impeded and their output less than they would like it to be. Professors of pathology and bacteriology have done their utmost to secure the adoption of the Whitley scale for their technicians. The main obstacle seems to be that this would mean raising the salaries of many other employees. At the same time large sums are found for new buildings, which suggests that the importance of adequate technical assistance is still seriously underestimated.

LETTERS TO THE EDITOR

DEAR SIR,

In the most interesting articles in your May number on the position of philosophy in our universities, the contributors either stated or implied that joint honours courses in philosophy and English were confined to the University of Bristol.

May I therefore be permitted to point out that such a course has been in existence in this University for a number of years, that its basis has recently been broadened, and that it has attracted, and is attracting, students of real promise?

Yours faithfully,

D. M. MACKINNON,
Department of Moral Philosophy,
King's College, Old Aberdeen.

DEAR SIR,

In the article by Mr. Stephen Toulmin on "The Place of Philosophy in other Honours Courses" published in your last issue the following passage calls for correction:

> "Only at Bristol, however, is there a formal joint school in the two subjects [English and Philosophy]. Elsewhere, literature is supplemented either by philology and Early English, or by a mixture of philosophy and other things, taught by non-philosophers under some such title as 'Life and Thought.'"

At Nottingham it is possible for students reading for Honours in English to take a two years' course in Philosophy (taught by the Philosophy Department) as part of the course leading to the Part I Examination. There is also an option in the School of General Studies in Arts in this University, enabling a student to take English and Philosophy with a third subject, which may be either History or Economics and Social History, or an ancient or modern foreign language, or Theology in Part I, and English and Philosophy in Part II of the Degree Course. This is, in effect, a combined Honours course in English and Philosophy.

Yours faithfully,

V. DE S. PINTO,
The University,
Nottingham.

SIR,

I direct myself solely to some of Stephen Toulmin's remarks in his paragraph on Philosophy in Arts Faculties. He expresses very neatly the impatience that philosophers commonly feel about the requirements of their colleagues in the literary departments. It is easy to appreciate that for someone trained in the rigorous discipline of philosophy the background study of "Life and Thought" or "History of Ideas" must appear to be mere "picnicking at the gates of the subject". And it is not difficult to understand that a philosopher who is passionately convinced that philosophy is the only worth-while subject of study must necessarily regret this dallying in the pleasant pastures outside, and must wish to entice the loiterers over the portico that alone can lead to "the truth".

Acknowledging all this, I believe that such an attitude prevents our philosopher colleagues from grasping the requirements of other departments. Students of Classics, English or Modern Languages are for better or worse students of Classics, English, or Modern Languages and not students of Philosophy; for the purpose of their chosen studies they do not need philosophy as defined by the specialists. A proselytizing approach implied by the use of words such as "the lack of a more strenuous intellectual training" or "as substitutes for the original documents" is hardly the best foundation for interdepartmental co-operation.

The fact remains that we non-philosophers are not interested in the detailed and critical study of philosophical arguments; it may be our loss, but there it is. It is precisely the "influence" of philosophical thought that is our concern. If the great philosophers had had no appreciable success in "shaping the thought" of their time, they would still be deserving subjects of study in their own right, but we as students of history or literature could safely forget their existence. As it is we cannot. Philosophical "background" is necessary to a proper understanding of the past, in some ages and in some subjects more than in others. It is here that our philosopher colleagues fail us signally.

I am concerned with teaching German literature, and my experience will illustrate the sort of demands which the Philosophy Departments fail to meet. Starting from the Cartesian world we want to know the following: (1) What Leibniz had to say, how these views became flattened and diluted by his popularizer, Wolff, and to what extent Wolff made a positive contribution towards

reconciling Leibniz's cosmogony with orthodox Christian views. (2) Newtonian thought became important in Germany around 1740, arriving by way of Holland and France. What were its implications? (3) The impact of Spinoza on the generation of the 70's. (4) The development in outline of Kant's views through Fichte and Schelling to Hegel. Kant's metaphysics are not nearly so important to us as the resistance they gave rise to, but this cannot be discussed without some knowledge of what it was that irritated the Irrationalists. (5) In the nineteenth century Schopenhauer is fundamental to the understanding of *fin-de-siècle* decadence, and (6) Nietzsche of course for the twentieth century. Of all these names Kant's is the only one that normally appears in the syllabus of the Philosophy Departments as I know them, and one is driven to the conclusion that our philosophers are not very familiar with other German thinkers. When discussing this point with colleagues, I have been given the answer that Fichte, for instance, was crazy. Perhaps he was, but for this very reason the importance of his influence cannot be overlooked in any study of the subsequent craziness of German development.

In such a "background" study of philosophy I am not interested in the intellectual training which a detailed study of such thinkers could give, but solely with the results of their thinking on the more normal mortals who figure in the histories of literature. The reading of philosophic texts need form no part of such a course. Against a clear background of the fundamental ideas, the literary or semi-literary products of a Lessing, a Herder, or a Schiller, to mention only three names, can be read with more profit than would otherwise be possible.

It is of course true that such treatment of the "history of ideas" is important chiefly in the case of a literature such as German, or an age such as the eighteenth century, where the literary giants are not very gigantic, and where the purely aesthetic approach can yield at best but meagre results. For those who hold that literary studies should concern themselves exclusively with works of art as works of art, German studies must appear unimportant, or they confine their attention to Goethe and a few make-weights. But there are some who look upon literature, whether it is first or third-rate, as a nation's most significant form of expression under the impact of changing events; and for them the subjective absolutes of aesthetic appreciation appear less important than the manner in

which the best creative minds of any age reacted to the current of ideas.

I have confined myself to the specific problems and periods with which I have primarily to deal. My colleagues in the English, French and other departments would doubtless outline different requirements. And all of us who are concerned with the development of modern European culture can scarcely dispense with the wider background of classical antiquity, and mediaeval and renaissance thought. The Philosophy Departments could, if they would, make our task much easier if they would forget for a moment the advantages of a real training in their strenuous mental discipline, and without too much condescension to us "weaker brethren," devise a syllabus which outlines the results of man's speculation about the Universe. Such a course may well be considered to debase "philosophy" as Toulmin envisages his subject; but it need be neither slipshod, nor woolly, nor gossipy, as I fear it too often is when we non-philosophers perforce have to turn out hands to it.

H. T. BETTERIDGE,
The University,
Glasgow.

REVIEWS

GOVERNMENT ASSISTANCE TO UNIVERSITIES IN GREAT BRITAIN. (Columbia University Press, New York. 1952.)

Three distinguished university men from the United States have visited this country within the past two years in order to be in a position to submit memoranda on this subject to the Commission on Financing Higher Education, a private agency sponsored by the Association of American Universities; and in this book we have published the reflections of each of the three. There is a good deal of common judgment between them.

Professor Louis M. Hacker, Dean of the Faculty of General Studies, Columbia University, has written on " The Universities and the Government in Great Britain "; Professor Lindsay Rogers, Burgess Professor of Public Law, Columbia University, on " The University Grants Committee "; and Dr. Harold W. Dodds, President of Princeton University, on " Government Grants in Aid to Universities in Great Britain ". Dr. Dodds was the most recent visitor and, since he had the advantage of seeing the other memoranda before writing his own, the " sense of the meeting " so to speak can be well judged from his essay.

Those of us who were brought up on Bryce's *American Commonwealth* and Lowell's *Government of England* are not likely to underestimate the value of informed criticisms by English and Americans of one another's institutions. We therefore approach a book like this with considerable expectations; and these are not disappointed. We may not accept the writers' conclusions; but after reading what they have to say our own thinking will never, I think, be quite the same again—it will change in estimate of background and in emphasis.

Perhaps we of the universities in this country are too modest, or too arrogant. Perhaps we underestimate our importance in the national scheme of things, or are happily content with an illusion that the great mass of Englishmen—I dare not speak for the Scotch or the Welsh—cannot be expected to concern themselves with our intellectual purposes. Not so these Americans, well as they know us and our country. " The average British voter "—the words are from Dr. Dodds, but the other two writers would agree—" is less interested in the universities than is the average American voter in his State university." The reason they think is simple. " Social changes to the contrary notwithstanding, the universities still exist

for the elite. . . . A university man is a person apart from the mass, no matter what his origin. Oxford and Cambridge graduates come first, of course; but those of the modern universities bathe in similar if less brilliant glory. This circumstance strengthens the defence of the universities against outsiders who may be tempted to move in on them." Dr. Dodds adds that no influential leader in Great Britain, Labour or Conservative, is seriously proposing that the universities be turned into institutions of general education for the hundreds of thousands.

How different is the American scene, where one boy or girl in four goes to college, and where it is accepted general policy that the number of students should be larger still. Naturally the American visitors assume that the public *must* take a lively, almost a daily, interest in the affairs of its universities. The numbers in themselves are not the main issue; or at least, in the tradition and conditions of this country, they raise wider questions than concern the universities alone. Many university men across the Atlantic think that our universities have taken the wiser road in keeping standards and numbers roughly where they are. The essential matter is elsewhere, though it is not unconnected in the American mind. We here have taught the public in the last half century that the universities are places where we train scholars and scientists and other rare persons who need difficult or recondite tricks. But the Americans have followed an older British tradition in looking upon the universities as places where the future of the nation is at risk, in a quite simple and quite inescapable way—because there is entrusted to them the care for four vital years of a most valuable part of the nation's youth.

Not unnaturally therefore the American visitors approach their enquiry with a strong sense that the possibility of taking a hand in university affairs must present to the politician, or indeed to the statesman, a temptation which is immensely strong and will in the end be irresistible.

But how do they think that things are going with us in the meantime? The introductory chapter to the volume may be allowed to speak for itself. " There is no basic disagreement in the conclusions of the three authors. They have pointed out that the British Government has become the principal financial support of the universities in the United Kingdom; that the machinery works well for the most part and is generally satisfactory to the Government

and the universities; and that, even with the greatest good will towards the universities and with the greatest respect for the traditions of academic freedom, Government financial support does not mean Government guidance of academic policy. All three also make it clear that the Government machinery works well in Great Britain because of social and political customs and institutions which are peculiar to this country and which are not reproduced or reproducible in the United States. Yet the potentialities of conflict between Government and universities are present, are recognized, and are beginning to occasion deep-seated anxieties."

Of course the three visitors, though they agree, could be wrong; and many in the universities here will think that they are in fact wrong. They themselves say some extremely nice things about us, and some things which tell the other way. They speak almost wistfully, as American public men have so often spoken before, of our capacity to do, and to be content to go on doing, by informal methods and very human contrivancies things that would be impossible of achievement by any rigid machinery, either of politics or of bureaucracy. And Mr. Dodds says, among others, two things which will please many people here; that "the long tradition of freedom which attaches to the ancient universities helps to protect the modern ones, and the closer contact of the latter with the people helps the former"; and that the tradition of academic freedom "is stronger than in any other country in the world." But none of the writers can get away from the pre-occupation that "the situation is still fluid," that in the end the government is bound to walk in.

The truth is surely that the question of our future lies in this. If in spite of receiving the greatest support from government the universities remain unmolested by government in their essential freedoms, it will not be because government dares to disinterest itself in the essential service which they must render to the nation. It will be because they perform that service well—better than they could do under any system of interference. If the future turns out so, it will be a tribute to the political sense of proportion and self-control of our people; and perhaps it would be in the character of few if any other peoples to show these qualities in just this way. But, even then, it cannot turn out so unless the universities see themselves as the nation is bound to see them, as the devoted and skilful educators of the young. C. R. M.

TECHNICAL EDUCATION FOR ADOLESCENTS : Some Thoughts on Present Problems. *By* C. H. DOBINSON. (Harrap, 7*s.* 6*d.*)

Though the 1944 Education Act is both a milestone and a signpost in our educational history, we have not progressed very far, for the intervening time is short and the signs are confusing. Many ways there may be, indeed must be into the promised land of an educated democracy but they are not easy to discuss, and they require much thought and searching discussion if our way is not to be lost and our hopes frustrated. In this provocative book Professor Dobinson succeeds in combining essential large-scale map making with a detailed examination of some confusing parts of the educational scene.

While the title of his opening chapter " Civilization and Technics " inverts that of Lewis Mumford's book, his brief survey is akin to that famous work in its philosophy and succinctness. After dealing with ' The Various phases of Education ' in the next chapter he then directs our attention abroad to what has been happening in France, both as regards vocational guidance and, especially since the war, to the Langevin Commission plans. His enthusiasm is infectious as he tells us of ' the problems through French eyes ' and proceeds to describe the novel ' Apprenticeship Centres.' But then a ' sales resistance ' develops as one feels a new, but not un-British theological assumption has been at work. This would seem to require belief in this geographical distribution of original sin, that the distribution is negligible abroad, while in England it is great and has not even the merit of being original. By comparing the best of things in France with the worst in England, the impression is created that technical education for our adolescents is in a perlous state. I do not say it is deliberately created but it has the dubious merit of being fashionable. While the French pupil takes to his studies as a duck to water, and by implication all do, much is made of the occasional absences of some boys attending English part-time day courses. The author says he will deal with " such pedagogical preparation of our purely technical teachers as is available in England and Wales " in Chapter V. But he does not and, indeed, it is astonishing to find no mention whatever of the significant work of our post-war Training Colleges for Technical Teachers nor of the interesting part-time courses of training for part-time teachers, and the newly developing part-time day courses for in-service teachers at technical colleges. While seemingly all French teachers are always most

carefully chosen and finely trained we are told, following a quotation of Thring's saying ' the waste in a teachers workshop is the lives of men,' that " there is much waste in the lives of men to be seen in some of the technical education in England ".

No one of any consequence now defends evening classes as the best or even an adequate way of educating adolescents, but is it really necessary to say that such studies " are too often given by mere technicians to mere technicians ". The harshness and waywardness of this description of many part-time teachers who are the salt of the earth are not lessened by quoting Sir Richard Livingstone's definition of such a person as one " who understands everything about his job except its ultimate purpose and its place in the order of the universe ". In so far as this is true also of some full-time teachers (even in France) is it a point of differentiation between full-time and part-time courses ? And is it really expected that the " mere technicians " who are taught—and who are, let us remember, adolescents attending in their own time—can know much or even a little about " the ultimate purpose (of their job) and its place in the universe " ? In making the foregoing comments, which could be much extended, one is open to the charge of being narrowly parochial, unwilling to learn from our education colleagues abroad. On the contrary, I am concerned that readers, especially those in technical education, shall not be put off and miss much that is of value in this book.

Professor Dobinson is most timely in his repeated insistence on the need for extended full-time technical education at the secondary and immediate post-secondary level. In this he is supported by the very strong recommendation (No. 24, p. 23) of the *Universities and Industry* Report. Moreover, quite apart from the abler pupils of the modern schools, his contentions are most relevant to the 27 per cent. of pupils who leave the Grammar school before 16 years of age, and the much greater proportion who leave at sixteen. There is no doubt that this group is of a size far beyond any errors of selection in the 11 plus examinations, and these pupils do not cease to be potentially able because they have not prospered in the —for them—uncongenial educational atmosphere of the grammar schools. The recent 5th Report of the Central Advisory Council for Scientific Policy also gives much attention to this problem. Many of these pupils have been caught up in the part-time courses in the technical colleges as the results of the part-time London External degree and the Higher National Certificate results show. But with

these advanced part-time courses one problem now overshadows all others—the greatly increased scientific and general educational content required for technological courses. There is now an urgent need for adequate means of transfer at appropriate stages to full-time courses, e.g. at the Ordinary National Certificate stage (at 18+ years) to three year full-time courses. Professor Dobinson compares the English part-time apprenticeship finishing at 21 years—which he admits may have higher standards—with the French full-time apprenticeship ending at 18, and suggests that the same standards may be secured at an earlier age in full-time study. As far as English technical education is concerned, and especially for potential technologists, the position now is that a longer and fuller course is required, finishing certainly not earlier than 21 years of age.

It would be unwise to assume that with an extension of full-time technical courses, part-time day courses will diminish in size and significance. Certainly they will—as remarked in a recent editorial of this journal—be the source of many technologists required for industry (though in making this reference we need not acquiesce in the contention that these will concern only the middle ranks of industry). It is not making a virtue of necessity to claim that a period in industry at this formative stage makes a significant contribution to the education of these students and to their selection. In this connection it is a pity that Professor Dobinson does not deal adequately with " sandwich " courses, in which industrial experience is an integral part of the overall period of training, as these are of rapidly growing importance. The question of whether the earlier full-time courses should be organized as sixth forms in secondary schools or as part of the full-time work of a technical college is a very controversial one. They are unlikely to be part of the work of regional colleges, which will provide full-time courses of at least three years duration beyond the secondary stage : at the other end of the scale a local college of further education in a small town is likely to have the secondary technical school as an integral part. In between these two, a variety of arrangements will obtain. From what he says here, heads of secondary technical schools will be apt to hail Professor Dobinson as a champion of their rights to sixth forms and parity of esteem. But let the arguments be on their own integral merits and not on such descriptions (quoted presumably because it is thought to be valid or sufficiently general as to be significant) of study in a technical college as being " merely a narrow life of ' swot '

in a comparatively lonely and alien atmosphere, unrelieved by . . . . the broader educational influence and enjoyments (such as) well developed social, dramatic, musical, and athletic activities". Some people really ought to see what really is happening under their very noses !

This book is not wholly or disproportionately concerned with the work of secondary technical schools and technical colleges, and Professor Dobinson is vitally interested in the work of the secondary modern schools, and the desirability of increasing and extending vocational courses within them. Repeatedly he comes back, as to a central point, to the vocational interests of the child. " In short, to the great majority of adolescents, whether pursuing studies in history and literature in a grammar school or taking what is given to them in a secondary modern school, education means primarily vocational preparation, or it means little." Only those to whom the honourable idea of " vocation " becomes debased when we speak of " vocational " education can take umbrage at such a view. Those who work in the technical colleges can testify to the dynamic effect of newly acquired vocational interests in the subsequent careers of many who leave the grammar and modern schools. Teachers in modern schools will probably welcome what Professor Dobinson has to say about making the most of the vocational interest, though they will still wonder about those capable only of repetitive or unskilled occupations of little vocational contact, and whose minds could scarcely generate a glow let alone be set on fire.

The current summer issue of *Adult Education* contains a thought provoking article by Guy Hunter on " Vocational and Culture—a suggestion ". Its theme is " the rehabilitation of work and the working life as the principal means of approach in adult education. It implies an idea of sequence—partly a sequence in the stages of life in which technical, vocational and ' pure ' education will come naturally but also as a sequence in approach to any group—a movement from living interests and feelings towards philosophy and the arts." Our schools may be " child-centred " but our education as a whole should be adult-aimed, and our hold on this continuing thread of vocational interests has been all too fitful. Within the compass of this small book Professor Dobinson has dealt with the earlier sequences both here and abroad, in a very stimulating way. His book is therefore strongly commended to all concerned with vocational and technical education, directly and

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even remotely—teachers, lecturers, heads and principals, administrators and (of vital importance in our democratic system of government) members of parliament and of education committees. Professor Dobinson's concern is with problems which are vital to the future well-being of this country and the happiness of our people : widely read and discussed, his book will enable the signposts into the future to be seen more clearly, and our steps to be set more certainly away from " the Waste Land " into that fuller life which was surely the aim of those who placed the 1944 Act upon the Statute Book. P. F. R. VENABLES.

THE ALCHEMISTS. *By* Dr. F. SHERWOOD TAYLOR. (William Heinemann, 12*s.* 6*d.*)

Adventurous spirits ever delight in mystery and the more adventurous try to penetrate them. In these modern days the efforts of a million explorers, scientists, savants—past and present—have laid bare if not explained so many of the secrets of Nature that fewer mysteries seem to remain. But what a wonderful era from the mystery angle was that of the alchemists, and how vividly is it retold by Dr. Sherwood Taylor in his most readable little book !

The writer of a nineteenth century book on the History of Chemistry—Ferdinand Hoefer—invited his readers to forget modern knowledge and transport themselves in imagination to the 5th century laboratory of some master of the alchemical art to watch as neophytes, seven experiments conducted to illustrate the theory that earth, air, fire and water were the four elements of the world. The evaporation of water leaving a residue (of " earth") and giving off " air " in the process ; the production of a combustible gas (" fire ") when a red hot iron was plunged into water ; the " death " of a metal when calcined and it's recovery on further heating with grains of wheat ; the recovery of a button of silver from the ash cupel in which lead had been heated ; from experiments such as these arose the principles of the Sacred Art and who can blame these early experimenters for their errors in interpretation. Indeed a very distinguished churchman of the 5th century—Nemesius, Bishop of Emesa—wrote as if he were stating an article of orthodox belief: " to prevent the destruction of elements, the Creator has wisely ordained that elements should be capable of transmutation one into the other or into their component parts, so that their component parts

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should be resolved again into their original elements. Thus the perpetuity of things is secured by the continual succession of these reciprocal generations."

This most remarkable pronouncement must seem as inspired to-day in this age of Atomic Physics (when exactly this type of re-generation is regarded as occurring, for example, in our own Sun) as it must have done to the 5th century alchemist.

And now to Dr. Sherwood Taylor's book.

His preface presents the case for writing at all and at such length about " Alchemy—the History of an Error." No excuse is necessary for the writing of so charming a work but I was as intrigued by the three reasons given as I trust many other readers will be also ! The main feature of the book—apart from its factual contents and references which are excellently arranged—is undoubtedly the free use of actual quotations and illustrations from the originals. Such reproduction in prose verse and picture is more than merely illustrative ; it brings vividly to the mind, as no other method can, the conditions and atmosphere of the times which allowed alchemy to flourish so exceedingly . Not only the ideas of the alchemists but the origins of their techniques and their wish, in later times, to prove their utility are described in full detail.

Speaking of the earlier alchemists, a revealing fragment of a letter from Zosimus to his sister is quoted as showing that interchange of information on alchemical matters was common enough in those days—" . . . . your priest Nilus moved me to laughter, burning his lead-copper alloy in a baker's oven as if he was baking bread, burning it with cobathia for a whole day. Blinded in his bodily eyes he did not realize his method was bad. . . ." The author goes on himself to say that " we have no more than a vague notion of what Zosimus was talking about but the passage gives us a tiny picture of the society of the chemical operators in Egypt (4th century) ". This is an example of the author's method in creating his atmosphere —a good and well tried method too. Another example, chosen at random from many others, is a recipe for " doubling " or increasing, gold from a smaller sample. " Copper of Calais, one ounce, orpiment, native sulphur one ounce, decomposed realgar one ounce. Boil in oil of radish, with lead, for three days. Put it in a roasting pan and place it on the coalstill the sulphur is driven off and you will find your product. Of this copper take one part and three parts

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Following this idea then, the marriage of Sol and Luna is depicted as an hermaphrodite corpse, black and putrefied but destined to be washed by celestial dew and so giving birth to new spirit.

All this symbolic alchemy, of course, expresses the view that changes in matter and living beings are analogous and religious influence, as is to be expected, is always there though usually in the background.

No one, surely, can read the long chapters on " Stories of Transmutations " without feeling the grip of good stories well told. There are three of them. All three full of interest, quite incredible to-day of course, but doubtless sound for a reader in 1600; though as Dr. Taylor quaintly observes, if a modern President of the Royal

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The author sums up in the later pages of his book the relation of alchemy to modern science and suggests that while the objects of the latter are limited (particularly in specialized fields) the latter set itself the quite unattainable objective of a complete scheme of things in which God, the angels, men, animals and the lifeless world all took their place, in which the origin of the world, its purpose and end were to be clearly visible.

In short, Dr. Sherwood Taylor has written a delightfully interesting account of the 1800-year-old alchemy, its evolution, traditions, symbolism, personalities and techniques, and shows how in spite of its many errors and few permanent triumphs it has led through the centuries to modern chemistry. R. WHIDDINGTON.

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